IRON & COAL
THE IRON AND COAL TRADES' REVIEW
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No. 4826 LONDON: FRIDAY, DECEMBER 30, 1961
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BELMOS NCB STANDARD RANGE

SBU.1. CIRCUIT BREAKER

200 ampere rating
BUXTON-CERTIFIED for Group I gases—Certificate No. 4242
Breaking capacity tested to 8·1 MVA at 550 V 0·25 power factor
Earth leakage protection with intrinsically safe lockout circuit
Intrinsically safe circuit for remote "Emergency Stop" control and electrical interlock

SGU.2 GATE-END BOX

150 ampere rating
BUXTON-CERTIFIED for Group I gases—Certificate No. FLP 3925
On-load isolating switch with tested breaking capacity of 1,200 amperes
"Long range" solenoid type overload relay
Earth leakage protection with intrinsically safe lockout circuit

SDU DRILL CONTROL UNIT

2·5 kVA transformer for supplying one 3 h.p. or two 1½ h.p. drills
BUXTON-CERTIFIED for Group I gases—Certificate No. 4087
On-load isolating switch
Individual reversing switch for each drill
Earth leakage protection with intrinsically safe lockout circuit

SLU LIGHTING TRANSFORMER

4·5 kVA transformer for supplying one 40 ampere or three 13 ampere lighting circuits at 115 volts
BUXTON-CERTIFIED for Group I gases—Certificate No. 4180
Output voltages of 115, 125, 230 and 250 volts—easily selected by changeover links
Individual circuit breakers to protect each secondary circuit

SGU. 30 GATE-END BOX

Up to 25 h.p. at 550 volts
BUXTON-CERTIFIED for Group gases—Certificate No. FLP 4318
Earth leakage protection with intrinsically safe lockout circuit
Intrinsically safe remote control circuit complying with NCB SPECIFICATION P130/1955
Stalled-current-breaking isolating switch
Remote control and sequence interlocking facilities

Over forty years devoted exclusively to the manufacture of motor control gear have earned for Belmos equipment a name for reliability and trouble free service.

Area offices are established throughout the country staffed by control gear specialists who will be happy to advise on any installation problem.

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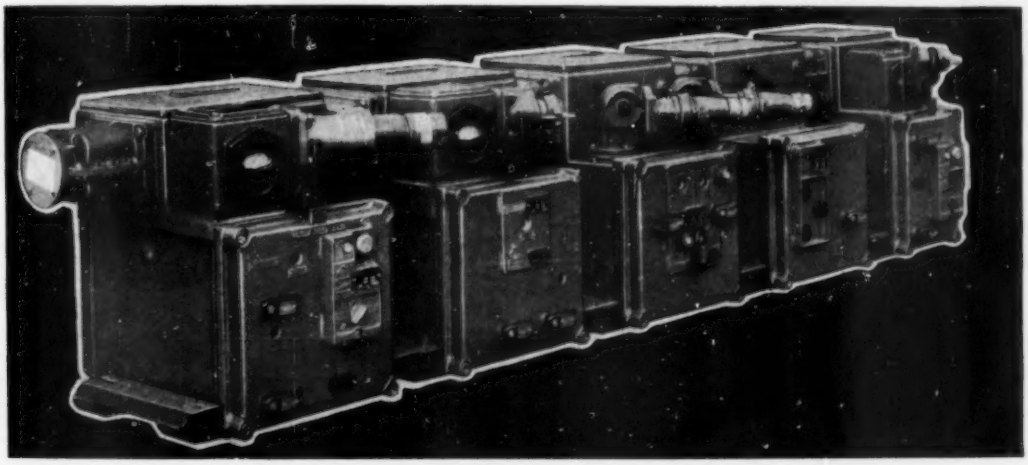
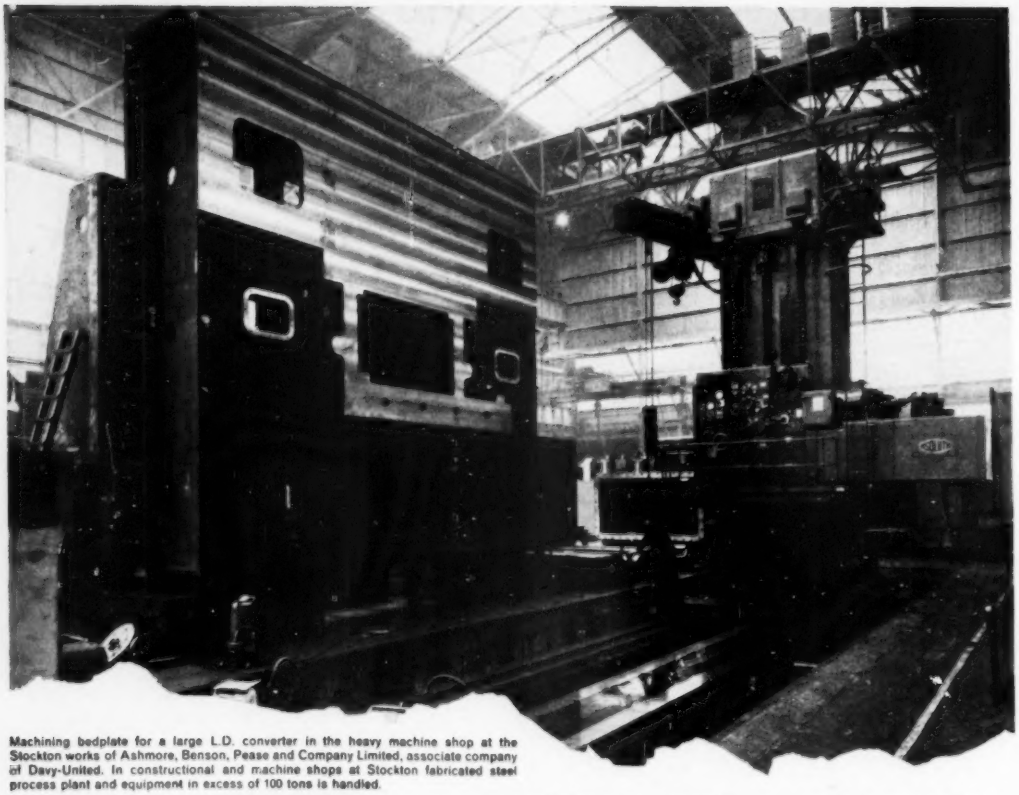


PAM 4048

LONDON GLASGOW BIRMINGHAM NEWCASTLE MANCHESTER SHEFFIELD CARDIFF

Steel PROCESS PLANT



Machining bedplate for a large L.D. converter in the heavy machine shop at the Stockton works of Ashmore, Benson, Pease and Company Limited, associate company of Davy-United. In constructional and machine shops at Stockton fabricated steel process plant and equipment in excess of 100 tons is handled.

DESIGN · MANUFACTURE · ERECTION

Complete oxygen steelmaking shops
Top blown, bottom blown and rotary converters
Ancillary equipment . . . casting ladles . . . scrap charging cars . . . slag ladles and carriages
Continuous casting plants
Project engineering for complete steelworks development schemes

Steel processes division

DAVY-UNITED | DAVY-ASHMORE GROUP

DAVY AND UNITED ENGINEERING COMPANY LIMITED · SHEFFIELD

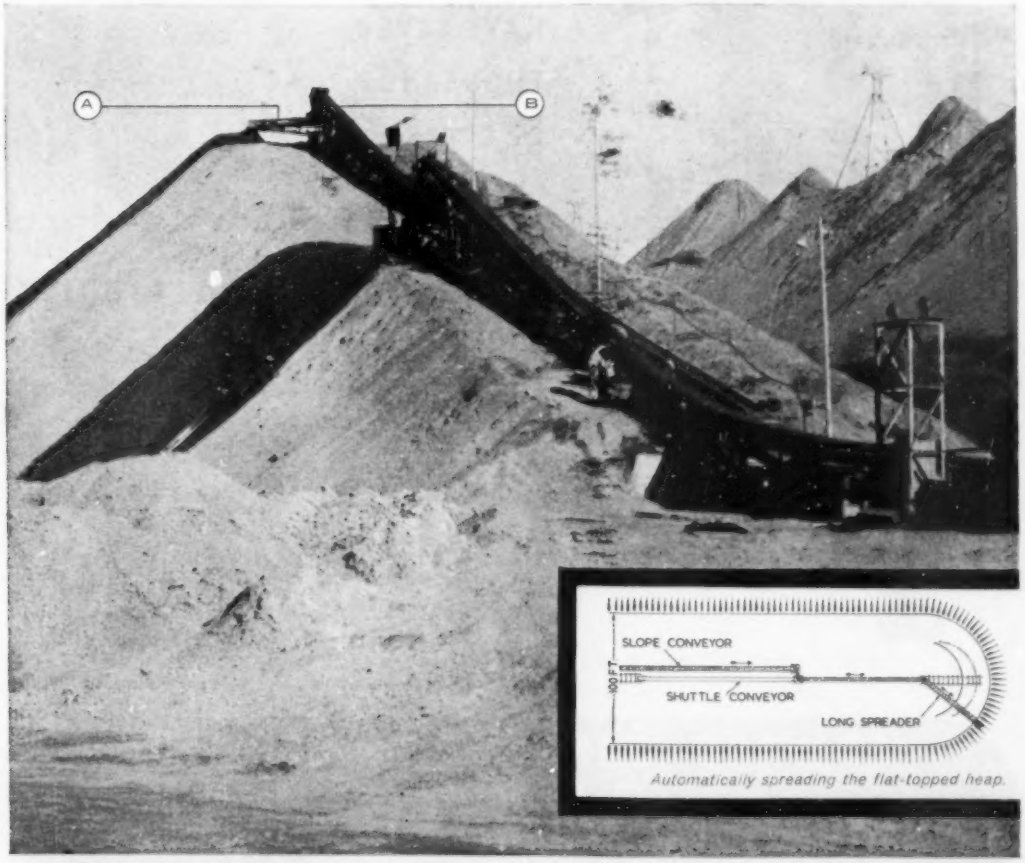
LONDON STOCKTON GLASGOW MIDDLESBROUGH HULL PARIS MONTREAL MELBOURNE SYDNEY JOHANNESBURG SALISBURY CALCUTTA BOMBAY

503

M&C 'GRASSHOPPER' DUMPS WASTE CHEAPLY AND WELL

With short spreader, the M&C 'grasshopper' builds the spoil-heap from the start. On reaching the required height, the long spreader makes a level top, spreading evenly and automatically, advancing a width of 100 ft. A shuttle conveyor inches forward on rails, so that the conveyor feeding it has only to be extended about every 150 ft. Ask M&C for particulars.

Making a new heap. (A) Short spreader. (B) Shuttle conveyor.



Automatically spreading the flat-topped heap.

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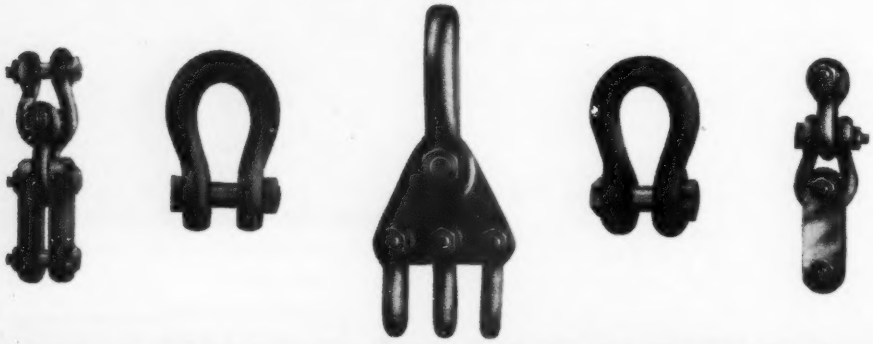

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GIB FIELD WORKS
ATHERTON MANCHESTER ENGLAND
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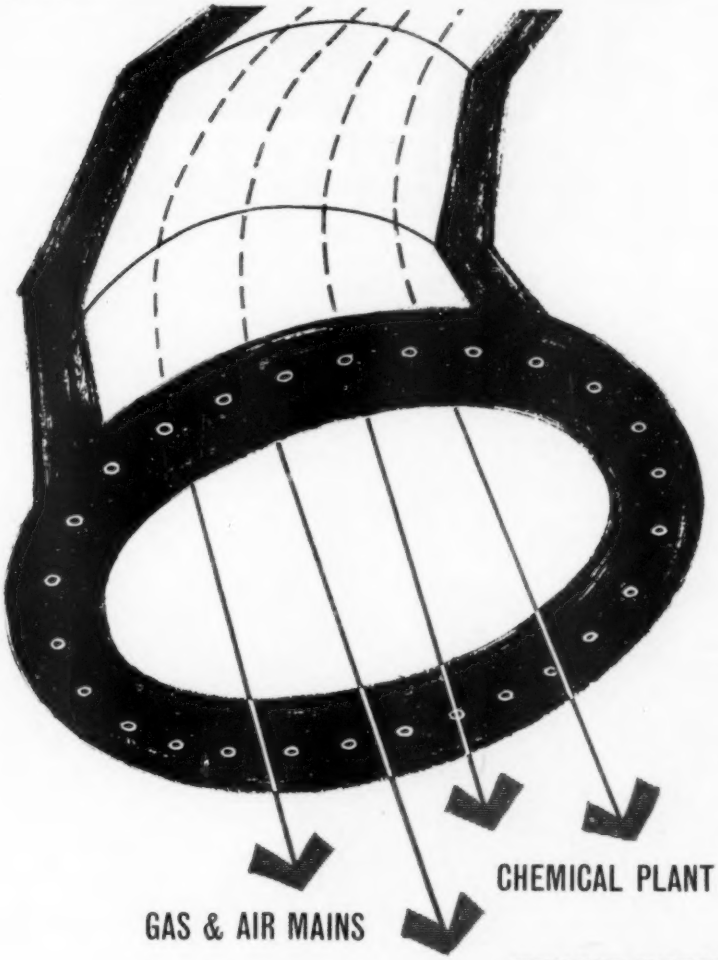

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who have recently placed repeat orders for these reliable locomotives. Brush shunters can be specially built to meet any industrial requirements.

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SUSPENDED IDLER BELT CONVEYOR STRUCTURE

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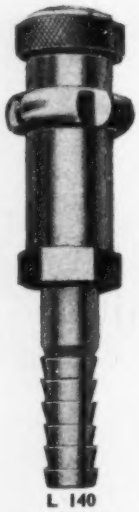
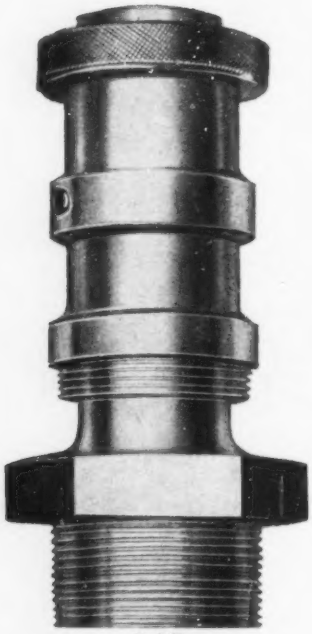


L 140
VARIABLE JET/SPRAY



L 142
VARIABLE JET/SPRAY FIXED SPREAD

L 141
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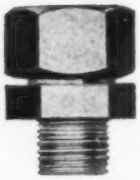
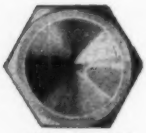
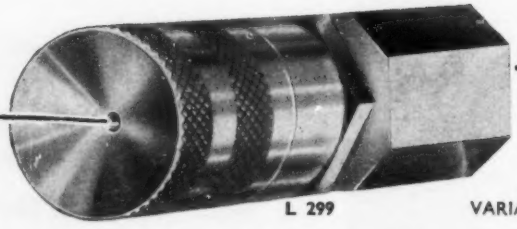


L 143



MIST SPRAY

L 175
TUB OR MINE CAR DOUCHE



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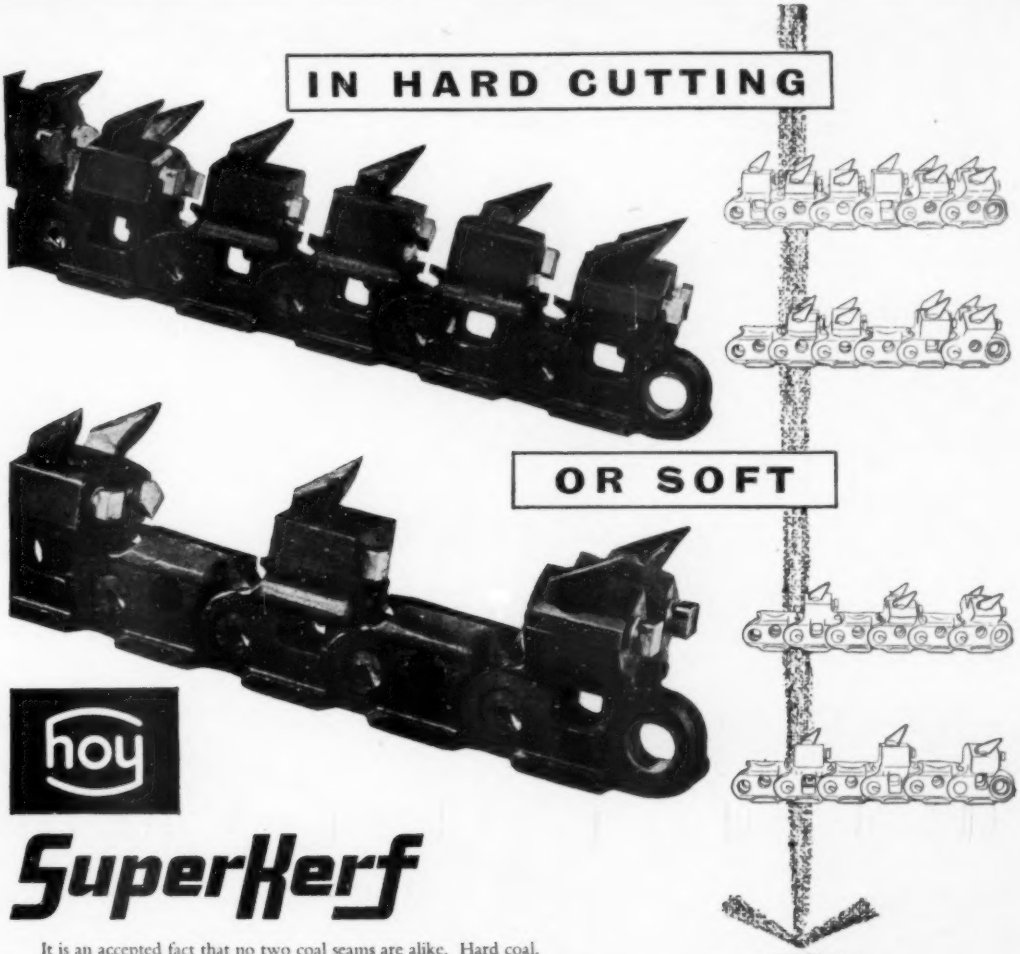


hoy

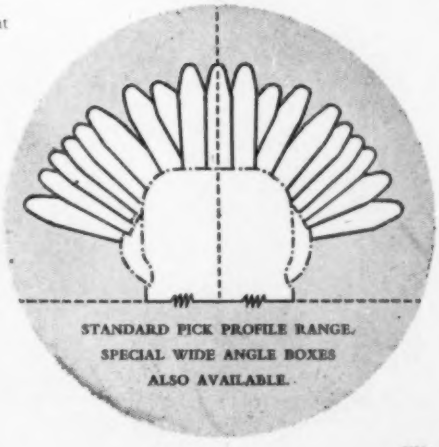
SuperKerf

It is an accepted fact that no two coal seams are alike. Hard coal, soft coal, faults, intrusions, dirt bands, inclinations, make each a different proposition when it comes to chain cutting.

The range of SUPERKERF standard cutter chain boxes includes nineteen single pick angles and three double pick angles, in addition to which there are connectors. It is therefore possible, using standard parts, to build SUPERKERF chains which are ideal for the work they have to do.

Hoy Engineers will be pleased to inspect seam conditions and to recommend SUPERKERF lacings which will give the fastest possible cutting speed with the lowest power consumption and, at the same time, ensure that kervings are of saleable size.

Write for broadsheet



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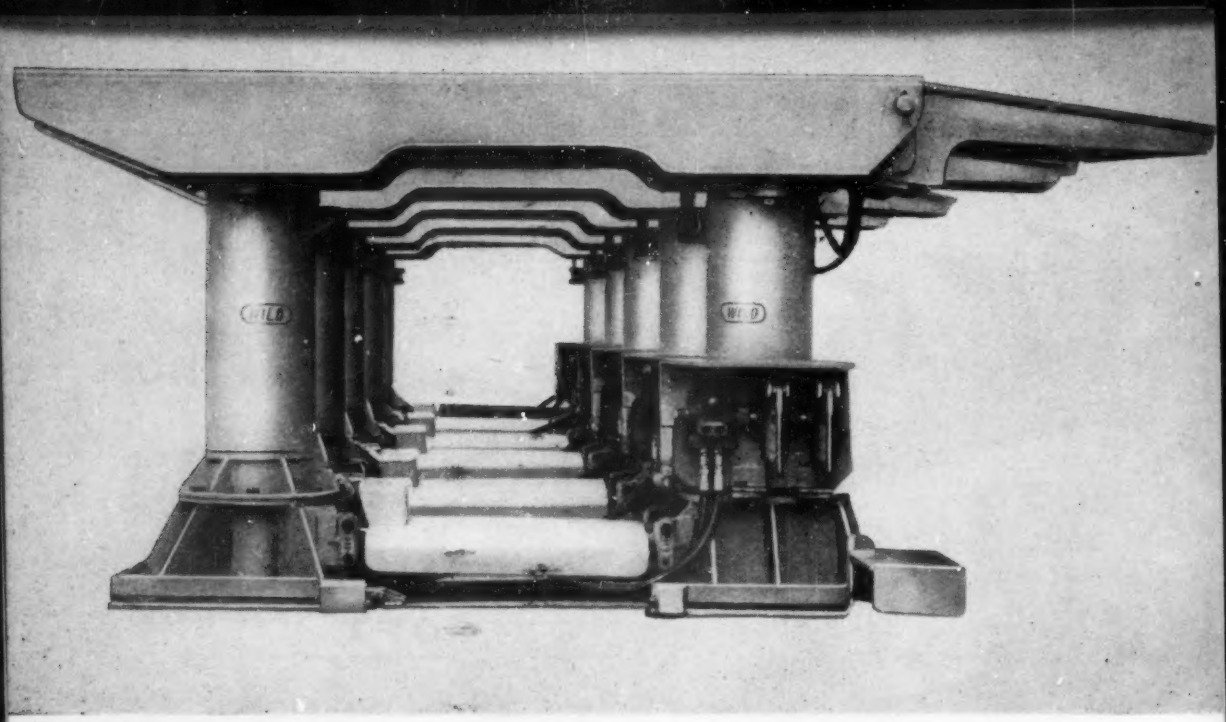
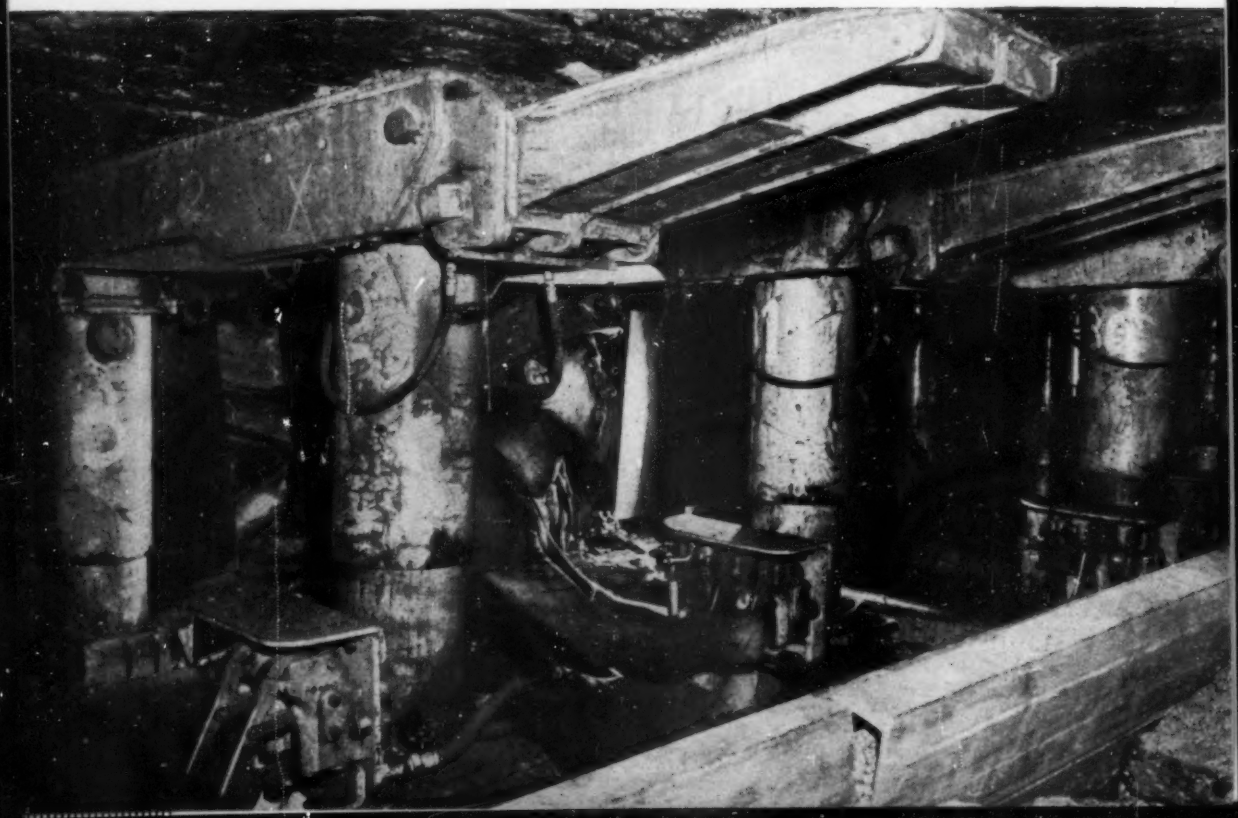


Above:
Goal Post type powered support system before installation at the face. WILD double-acting rams actuate the units.

Below:
An installation of Goal Post type powered supports.



SUPPORT SYSTEM

BY

WILD

The Desford range of roof support is now widely used in the coal fields. This equipment is designed to withstand the rigorous conditions underground. It operates on water pressure from the high pressure main or pump and is extremely simple to control; yielding is entirely automatic. Due to simple and robust design maintenance is cut to the minimum and components can be easily exchanged at the coal face in a matter of minutes.

Top: 50 *ton thin seam Desford Chock.*
Centre: 100 *ton Desford Chock with pedestal.*
Bottom: 100 *ton Desford Chock with ratchet extension and ram.*

Fully illustrated brochure is available giving full details of the range of Desford Hydraulic Chocks and Powered Supports. SEND NOW FOR YOUR COPY.

These Chocks are covered by B.C.S. and WILD patents.

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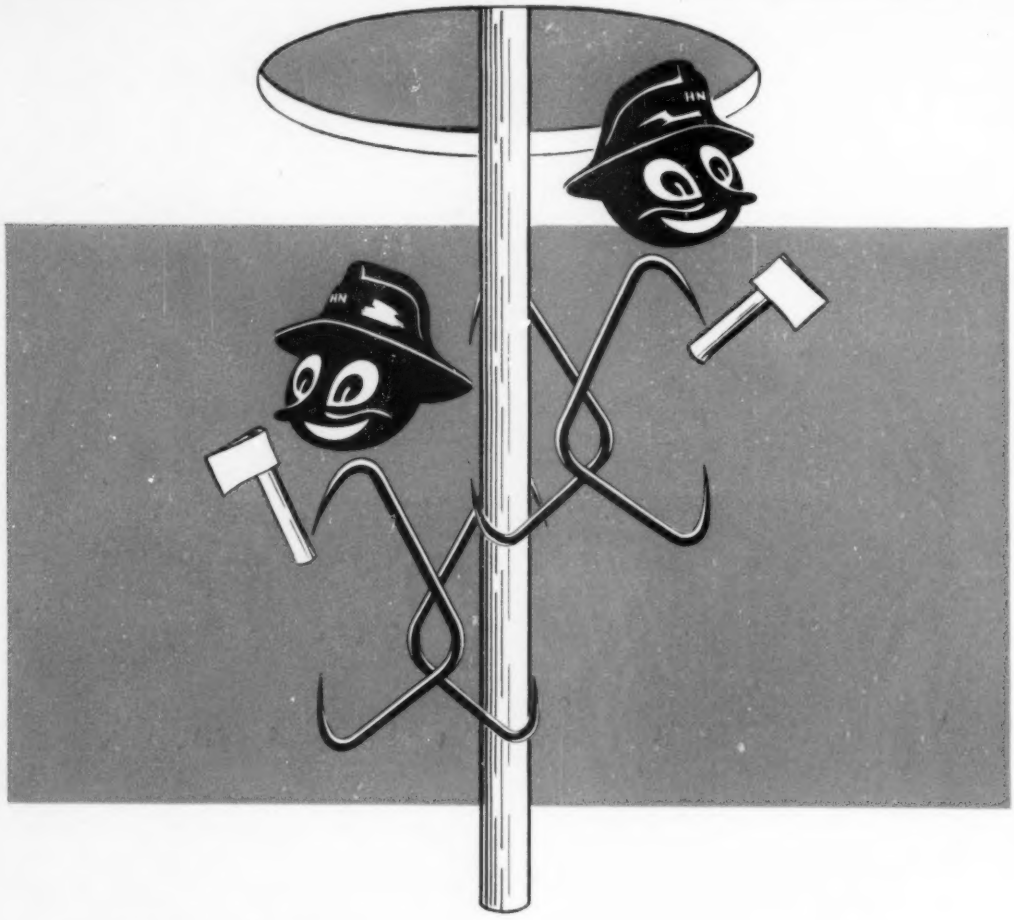

The twins are always on call

There's no cause for alarm when conveyor belts play you up—even at the most awkward times. The Twins have always provided a 24 hour emergency service which means that a call to Sheffield will put them immediately on the road to the trouble spot. No faster or more efficient belt repairing service is available anywhere.

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The man on the spot...

HUWOOD *Slung Structure*

Much of the present-day demand for conveyor structure which can be suspended from the roof has been created by the availability of Huwood Slung Structure—the first choice of a growing number of those mining engineers whose judgment in such matters is sharpened by day-to-day experience.

In common with many other Huwood elevated structures for use in gate and trunk roads, Huwood slung structure is based on the F.T. section which is fitted throughout with Huwood self-lubricating oil-filled rollers and is one of the most robust and serviceable conveyor sections used in present-day mining.

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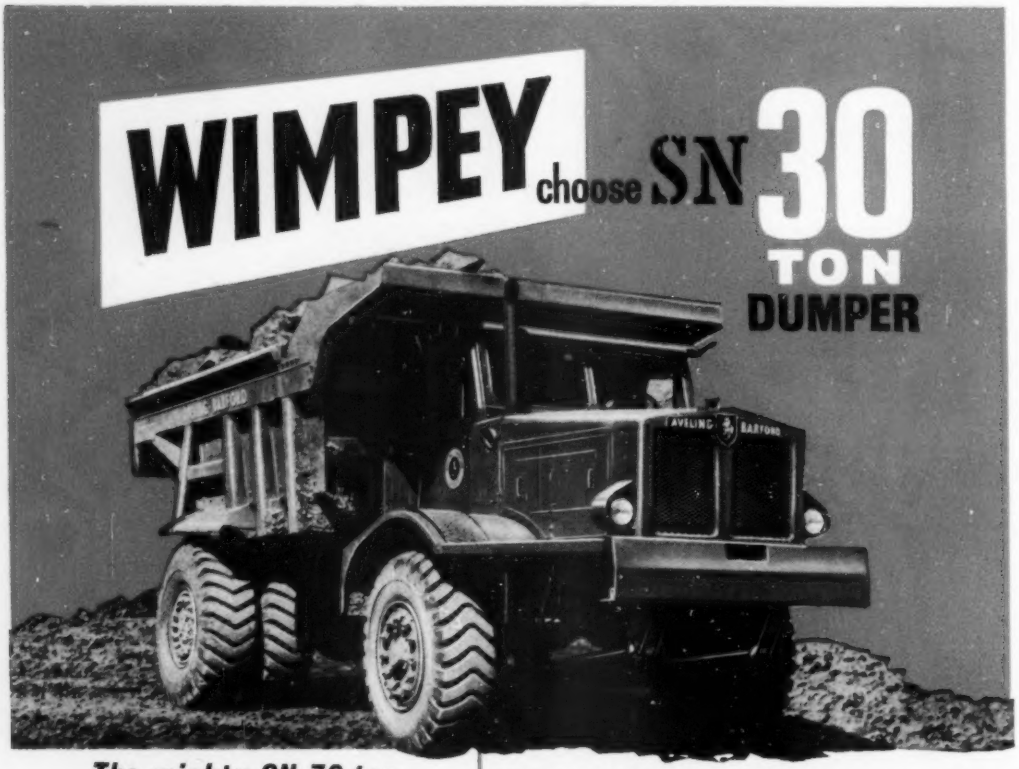
F/FA/202

WIMPEY choose SN 30 TON DUMPER



The mighty SN 30 ton outperforms all dumpers in its class!

GEORGE WIMPEY & CO. LTD., the largest contracting organisation in Europe are the latest of the big contractors to order Britain's most powerful dumper the tough Aveling-Barford S.N. 30 Ton. They know that this powerful, ruggedly built machine can handle the heaviest loads under the roughest conditions, with speed and ease. Six forward and one reverse speeds with a top of 30 m.p.h. from its 400 b.h.p. Rolls Royce turbo charged engine, or 33 m.p.h., with Allison Torqmatic No. CLBT 5940, give it immense power and manoeuvrability.
The body stands up to the heaviest punishment from impact loading. The hydraulic tip can be held at any angle.
For full particulars of the 'SN' write for Publication No. 1852.

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Aveling-Barford 30 TON DUMPER

AVELING-BARFORD LIMITED · GRANTHAM · ENGLAND

machines to make men giants . . . .

Given the tools to bring out the coal, today's miner has the output of a giant. His labour is multiplied a hundredfold by such machines as the Joy Continuous Miner,* a continuous cutting and loading machine which is hitting new heights with production figures in British coalfields.
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* *The Joy Continuous Miner is adaptable for a variety of seam heights. It cuts loads and feeds at approximately 3-4 tons per minute. To explore the possibilities of using this and other Joy machinery in your own workings, consult a Joy mining engineer.*

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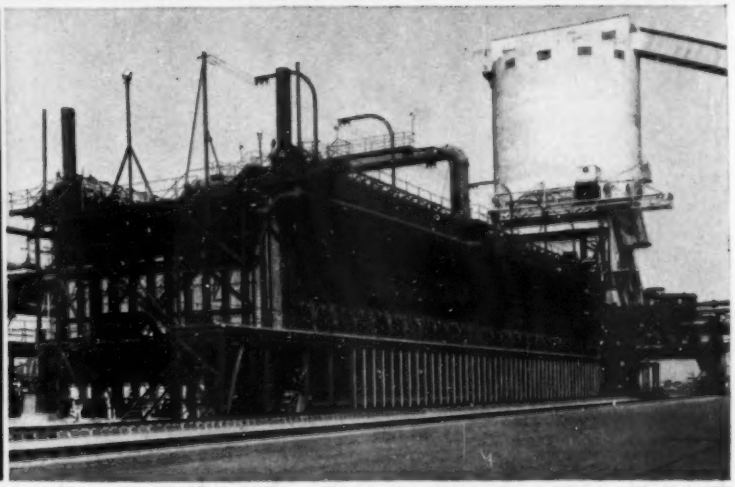

CORBY—THE DEENE COKING PLANT

The commissioning of the new Deene Coking Plant at Corby marks the completion of the first stage in the coke oven development programme planned for Corby by Stewarts and Lloyds Limited.
The new installation comprises a battery of 51 Woodall-Duckham Becker coke ovens with a coal carbonising capacity of 1120 tons a day, a by-products recovery plant and extensive plants for coal handling and blending and coke handling, screening and storage.
This is the sixth W-D coking installation to be built at Corby for Stewarts and Lloyds Limited.

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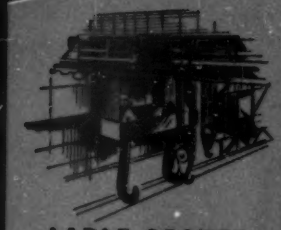
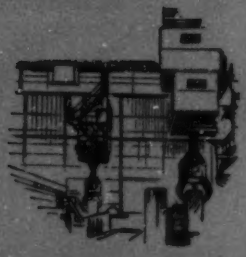
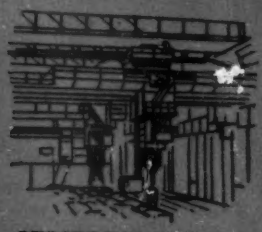
STEELWORKS EQUIPMENT *by* ADAMSON-ALLIANCE



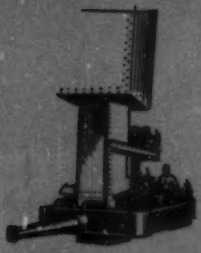
LADLE CRANES



SOAKING PIT CRANES



STRIPPING CRANES



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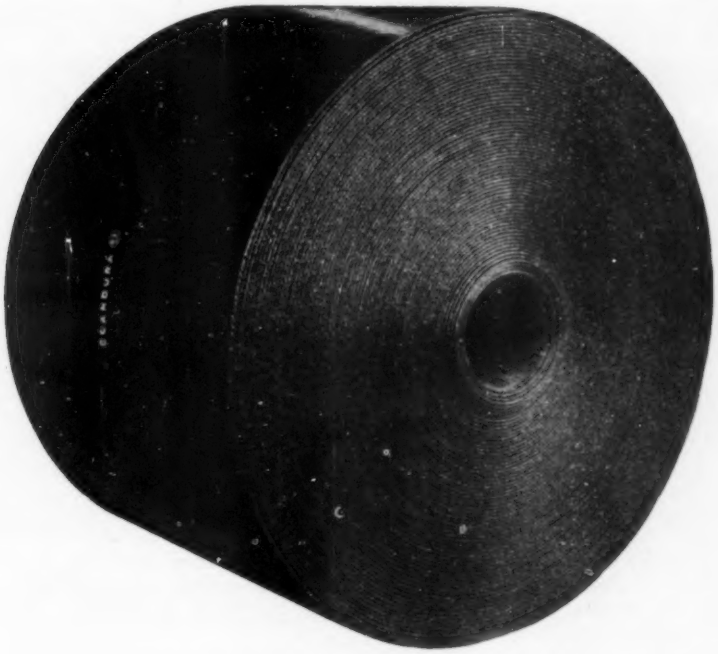

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the accepted name in mine conveyor belting

On the first length of plastic covered belting ever to be installed in a coal mine, you could read the name 'Scandura'. That was in 1948 and ever since then more and more mines have been replacing their belts with Scandura. These years of manufacturing experience have helped to make Scandura Gold Line the finest belting of its kind available anywhere.

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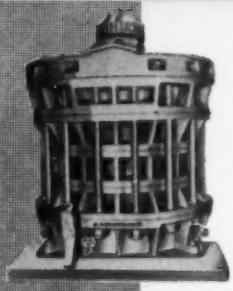
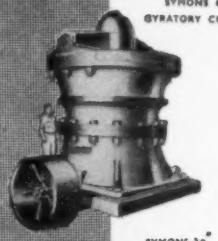
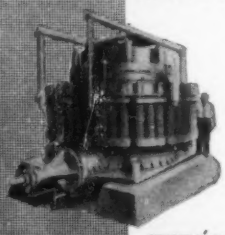
SYMONS Gyratory and Cone Crushers for primary and fine reduction



SYMONS 60" GYRATORY CRUSHER



SYMONS 30" GYRATORY CRUSHER



SYMONS 7' EXTRA HEAVY DUTY CONE CRUSHER

Greater productivity through more efficient crushing.

Complete range of sizes from 6 to over 3500 tons per hour!

'Symons' Gyratory and Cone Crushers are the outstanding choice of the mining and quarrying industries because they assure maximum and continuous production at low operating costs. For heavy duty primary breaking, 'Symons' Gyratory Crushers are available in 30in., 42in., 54in., 60in. and 72in. sizes, for capacities up to 3,500 and more tons per hour. For secondary and finer reductions, 'Symons' Cone Crushers in both standard and shorthead types are available in sizes ranging from 22in. to 7ft.—in capacities from 6 to 800 or more tons per hour.

Further information and literature gladly sent on request.

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where wet conditions are a hazard

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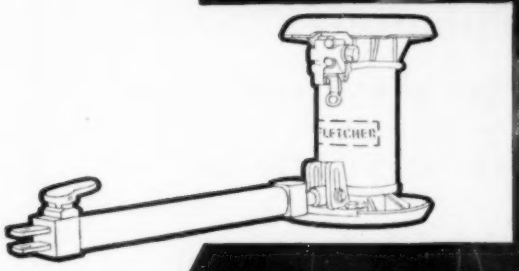
in action



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Following successful installations in the East Midlands Division, the Fletcher Desford hydraulic chock has gained a reputation for reliability.

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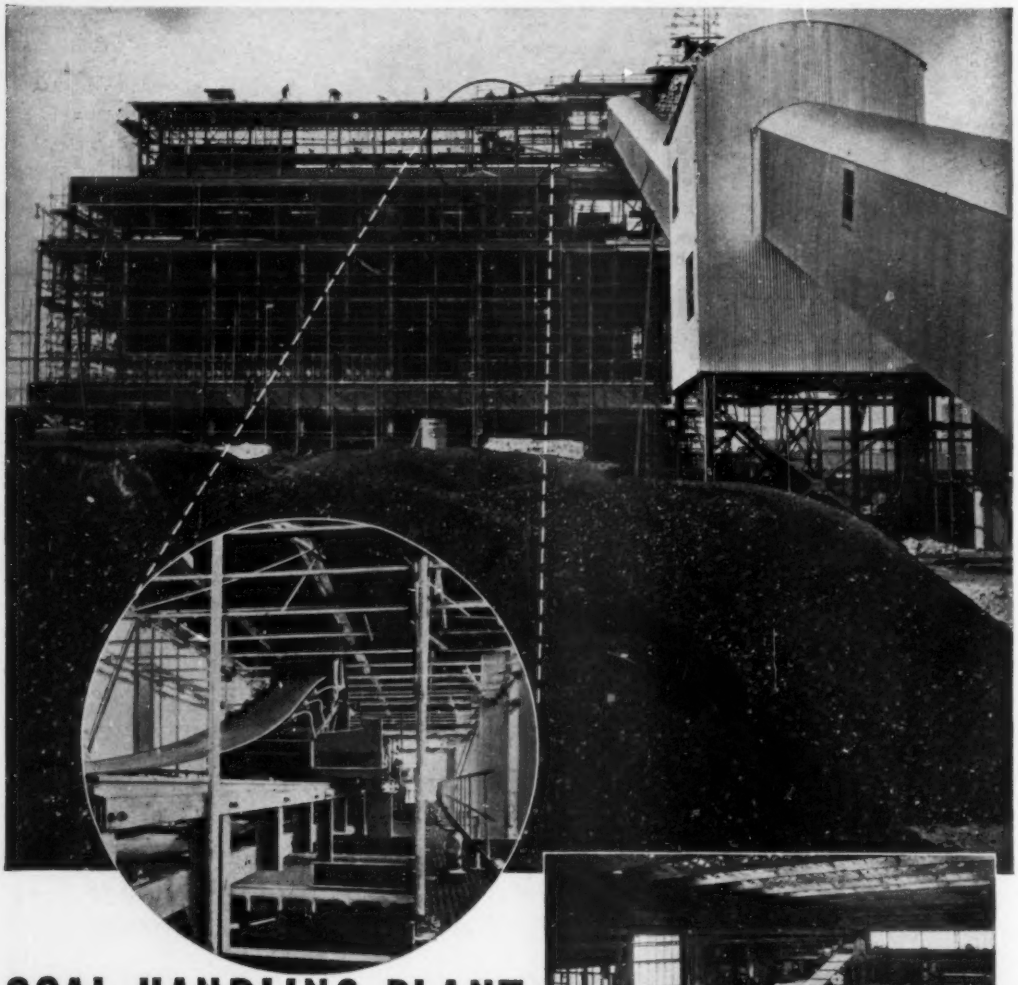

COAL HANDLING PLANT

Illustrated above, during construction, is the boiler house at Messrs. Courtaulds Ltd. new Grimsby factory. The coal conveying plant was manufactured by John Thompson Conveyor Co. and handles 100 tons an hour, receiving from both rail and road transport, feeding boiler house bunkers via a distributing conveyor and automatic tripper.

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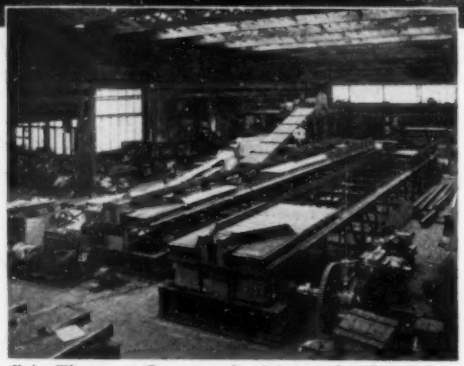

John Thompson Conveyor Co. fabricated and manufactured twin apron plate conveyors, each 60 ft. long by 7 ft. wide to the design of Davy & United Ltd., for the Dorman Long rod and merchant mill.

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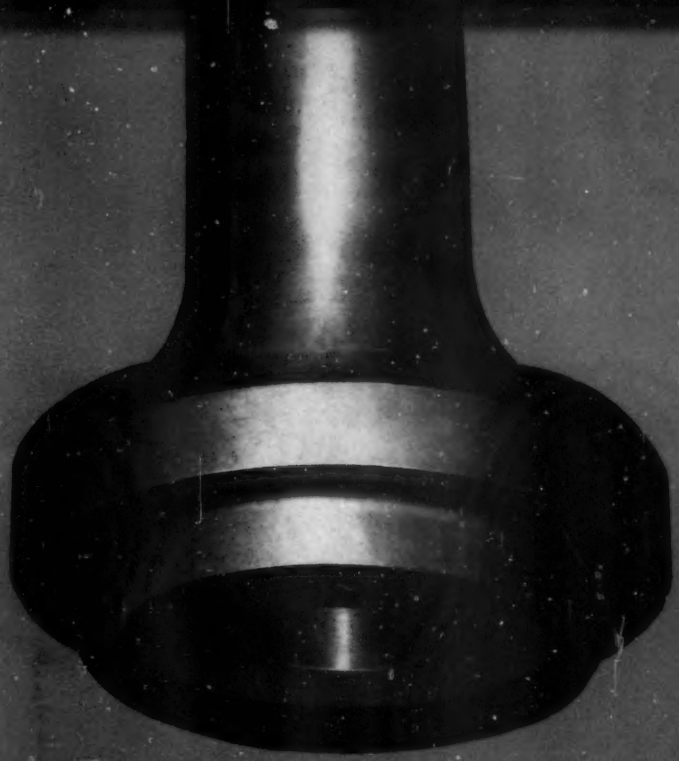

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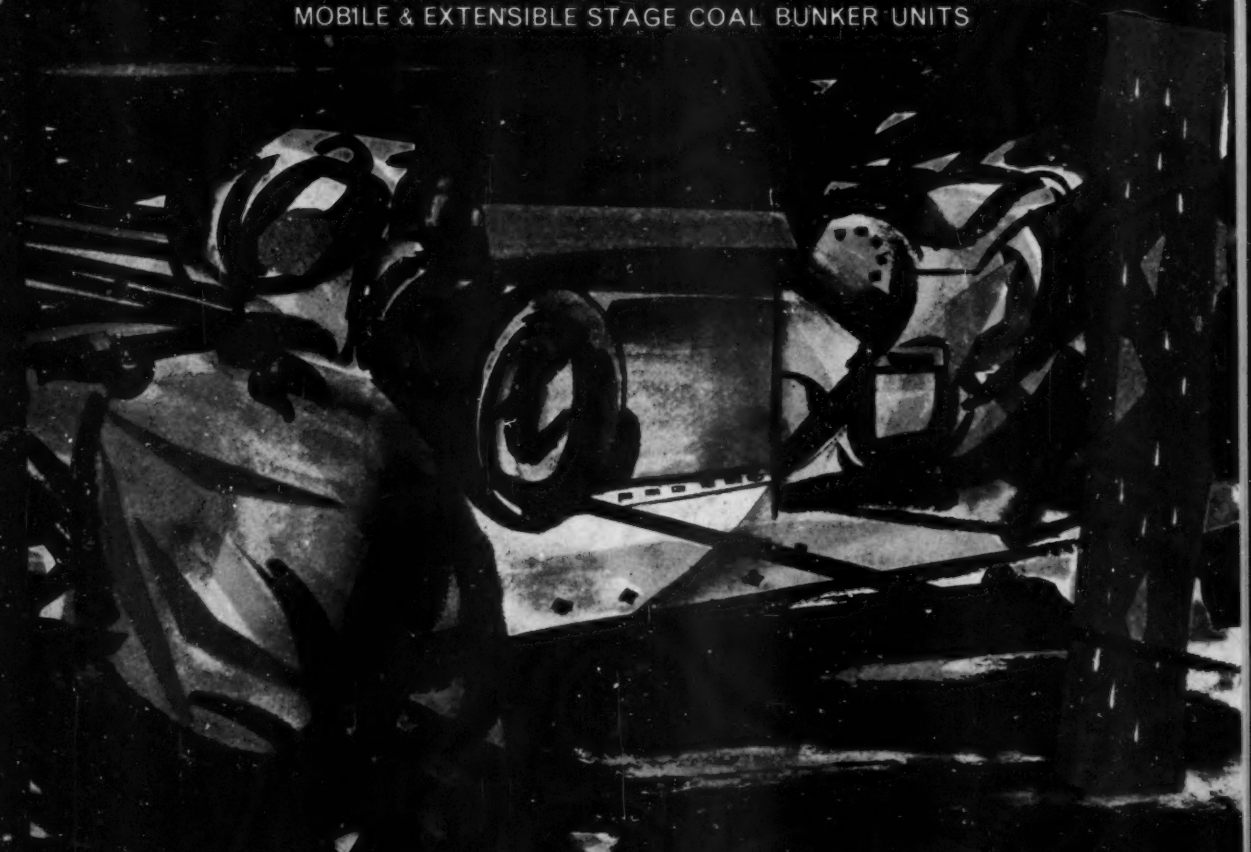

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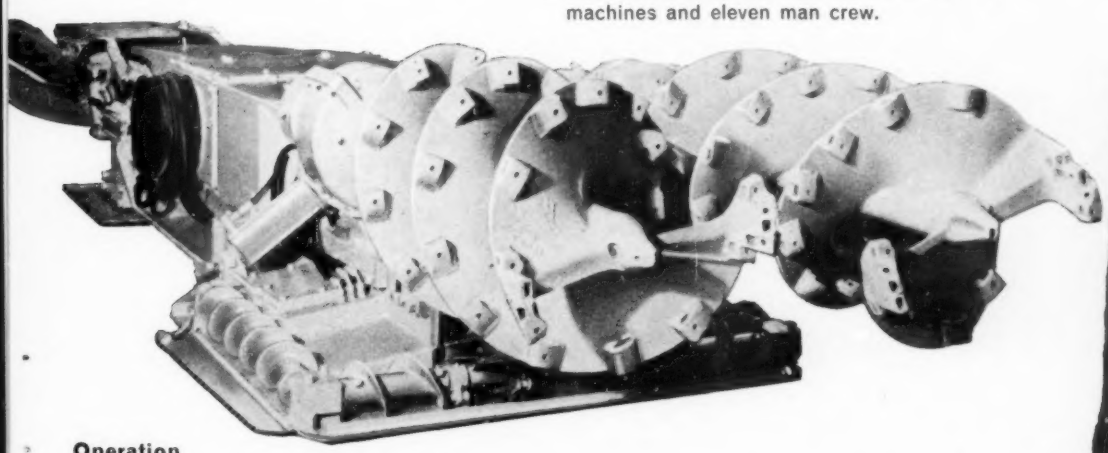

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1. Motor driven augers through reduction gearing rotating in opposite directions—forward oscillation prevents coal binding.
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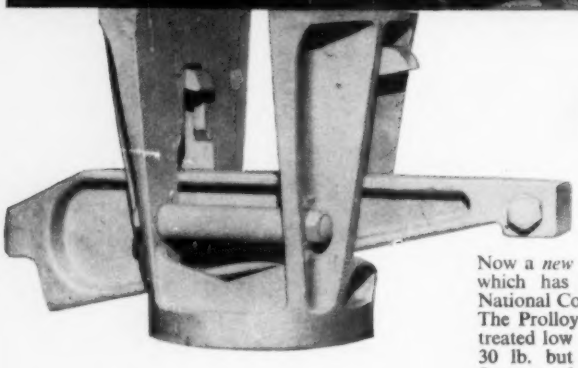

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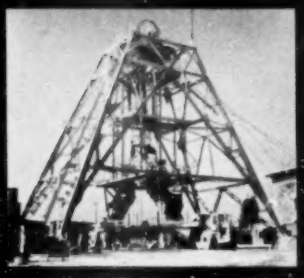
—not quite, but the lion is not so far from Northern Rhodesia's Mufulira West mine where Cementation completed to schedule four new shafts totalling 9431 feet despite difficult granite conditions. Mufulira highlight —a record 468 feet sunk and lined in one month at No. 14 Shaft (below).



In Africa and many other countries mining engineers of the Cementation Group of Companies maintain their world-wide reputation for deep workings. Into the granites of Northern Rhodesia's Copperbelt, deep into the salt beds of New Mexico, through unstable water-bearing sands to Canada's salt deposits, and down to the coal measures of Britain, Cementation engineers drive their shafts. Their specialist knowledge, based on more than 40 years' experience, provides the key to the most economical methods of working in any kind of strata — shafts, underground reinforced concrete constructions, pit bottoms and junctions, tunnel drivage, underground dams, pneumatic stowing. Mining engineering is one of the Cementation Group's comprehensive services embracing civil engineering, building, piling, vibroflotation, cementation, guniting, soil stabilisation and site investigation.

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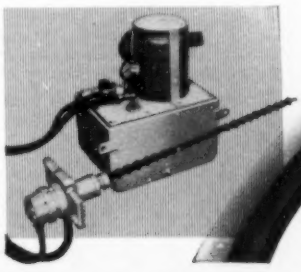

The Gladiator Drill with power pack comprising 5 h.p. flameproof electric motor, pump and tank.

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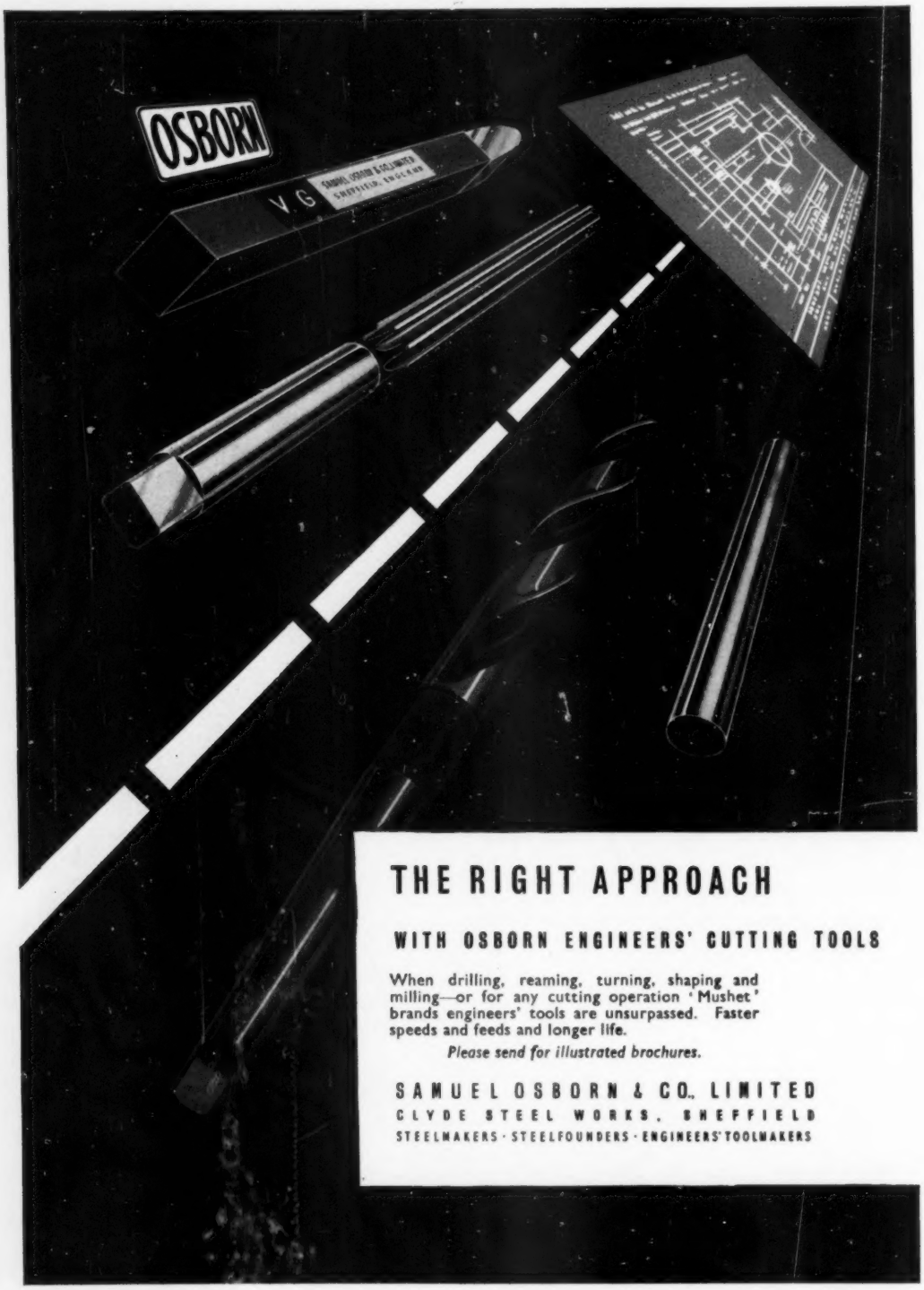

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Vol. 183
No. 4876

IRON & COAL

THE IRON AND COAL TRADES REVIEW

DECEMBER 29, 1961

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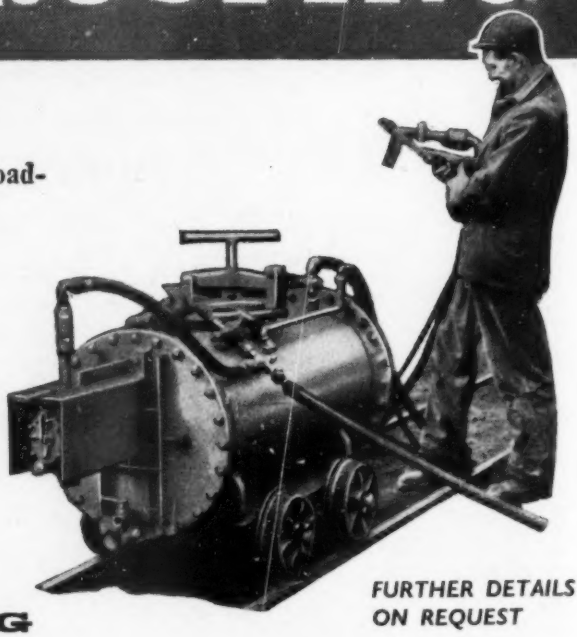

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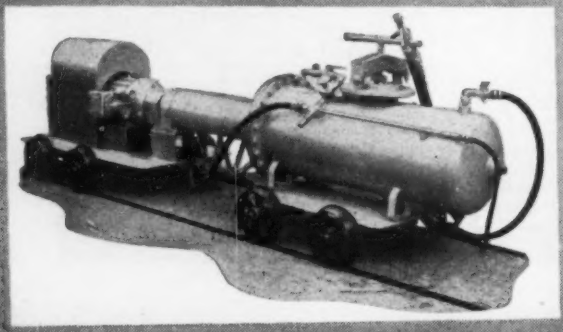
THE WITT FIREPROOFING MACHINE FOR INTAKE ROADWAY TIMBERS

The Witt Fireproofing Machine simplifies conformation with the Mines and Quarries Act 1954 section 70, in respect of retardant coating. The machine can be supplied with a trailer unit containing a flameproof motor and compressor for use in roadways where compressed air is not available (illustrated below) or with an air motor for connecting to a compressed air supply (illustrated above). The machine may also be used for rapid whitewash spraying or to provide power for a pneumatic pick or drill.



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IRON & COAL
THE IRON AND COAL TRADES REVIEW

Vol. 183 December 29, 1961 No. 4,876

Valedictory

THIS is the last issue of THE IRON AND COAL TRADES REVIEW for 1961. It is also the last issue that will appear with that title. To us, saying goodbye to the name we have carried for nearly a century comes harder than voicing a farewell to 1961. We do not, however, regard it as a sad, or even a bitter-sweet occasion. Time cannot be cured of its habit of marching on, and of registering changes as the years like milestones mark the way. A title which was fully descriptive in the 1860s is not so aptly adequate in the 1960s. As from the beginning of the year we become STEEL & COAL. We shall continue to chronicle events and register technical progress in the twin industries under the new title as under the old, but with a new cover, new type, a new format—and even greater zest.

As STEEL & COAL we face 1962 in the knowledge that we carry with us a heritage of achievement inscribed in the pages of 4,876 issues of IRON & COAL, and in doing so we pay tribute to the skill and perspicacity, the labour and the personality the men who produced those issues put into them. Together with the coal and steel industries which we serve, we look proudly on the past and confidently to the future. We make our farewells to 1961 gratefully, and with no more than nostalgic regret, for it is only a title that departs with the year on December 31; on January 1 IRON & COAL is in STEEL & COAL born again.

If output is the criterion 1961 was not a good year for coal and steel, but though below the best, it was substantially better than the worst. Technically, both industries made progress. Productivity improved, and it is efficiency of production that will count in 1962 and the years to come. Steel production seems likely to come out at about 22¼ million tons. Manufacturers had hoped for another 2 million tons or more, and although their hope was not realized, they can take comfort from the fact that actual usage of steel did not fall to the extent that the output figures would seem to suggest. Nearly all consuming trades took less steel in 1961 than in 1960, the motor-car manufacturers particularly, but it is calculated that during the third quarter overall usage was only some 5 per cent. below that for the same period of 1960. The fall in production below the range of 24-25 million tons which was the estimate early in the year was largely due to the heavy withdrawals from stock made by the consumers since the early summer.

A smaller steel production and lessened activity in industry generally have meant a reduced call for coal. Total coal consumption was about 4½ million tons less than in 1960. Up to the end of November, the only increase in inland consumption was some 3 million tons at power stations. There were reductions of 2.1 million tons by domestic consumers, 1.9 million tons in industry, 1.3 million tons by coke ovens, and 1.1 million tons by railways.

No great advance in steel production seems generally to be expected before the middle of 1962, but improvement may come sooner. Recently there have been signs that production is levelling off, rather than continuing to fall, and although there is as yet no evidence that consumers are having second thoughts about stock withdrawals, a decision to make smaller inroads into reserves would quickly be reflected at the steelmaking plants. An upturn in steel, based on greater activity in industry generally, would soon show itself in coal. Through its publicity efforts, its liaison with manufacturers of consuming appliances, and by dint of sheer hard work on the marketing side, the coal industry is rapidly improving the "image" of coal in the public mind. That in itself augurs well for the future of the industry. In steel, efforts to improve the quality of the product and to find new outlets for ferrous materials are bearing fruit.

The year 1962 may fairly be expected to bring better times for coal and steel. In the long term there can be no doubt about a continuance of large-scale demand. Both industries can view the future with confidence. STEEL & COAL will march with them into that confident future.

Accident Prevention Training Centre Extended

TO help in the 1962 drive to prevent industrial accidents, the Birmingham Industrial Accident Prevention Group has opened a new extension to its training centre at Adcocks Green. Welcoming the extension, Brig. Ralph Stoney, director-general of the Royal Society for the Prevention of Accidents, underlined the past achievements of the group.

Among the 2,000 students this year, 500 apprentices, nearly double last year's figure, had passed through the training course. New courses included studies on plastics, dropforging, and one for insurance engineers. Over the last 20 years, safety training has become recognized as an important contribution to increased productivity as well as a welfare aspect.

PRODUCTION of raw steel in the US during the week ended December 18 was 2,200,000 net tons, an increase of 1.9 per cent. over the previous week, the Iron and Steel Institute states. Actual raw steel output in the current year totals 93,311,000 tons, a fall of 2.8 per cent. compared with output in the same period last year.

Passing Thoughts . . .

WHY does not some statesman tell the people in plain words they have a choice. Either steady wages and steady prices, or rising wages, rising prices, and another devaluation. Talk of "productivity" and the worsening economic situation means little to many. —Letter in The Times.

The system of assuming that the graduate must have a too big sense of importance for his new environment and therefore setting him as his first job to sweep the factory floor—not an imaginary example—seems to me to be ill advised.—SIR MALCOLM KNOX, *Principal of St. Andrew's University.*

One lesson of the last few years in steel is that a higher level of capacity, of output, of consumption—and of confidence in reasonably early deliveries—seems at present to be making for larger fluctuations in the industry's operating rate.—The Economist.

The [Scottish steel] industry is in the position of a man who is short—and indeed, very short—of siller, but just about to receive a big legacy in property that at the very worst will be fruitful in returns.—DAVID MURRAY *in the Scotsman Survey of Industry.*

I have been deeply perturbed at the apathy shown by the general public, and even by the miners about the pit closures. . . . I, for one, think the miners of Scotland are being extremely mild and I wish there was a little of the old militancy available for the present crisis.—The REV. BRIAN CROSS in a letter to the Scotsman.

We are constantly being told that the coal industry is in the red, but the remarkable thing is that the coal industry has not had one brown penny of subsidy from this Government.—MR. JAMES HILL, *Labour MP for Midlothian.*

I shall not sell my soul, or my ideals, even though they are unpopular to certain people. The miner works hard and lives hard and expects hard-headed leaders and that is what we are.—MR. SIDNEY SCHOFIELD, compensation agent, Yorkshire Area NUM.

If there is to be a post-mortem on the shipbuilding industry let it embrace all the industries that are involved in building a ship.—SIR ERIC YARROW, *managing director of Yarrow & Company, Limited, shipbuilders.*

AIRCRAFT FOR COAL BOARD

LORD ROBENS, chairman of the National Coal Board, has ordered a De Havilland Dove aircraft to cut his travelling time and that of senior members of the board. It will cost £50,000, and is expected to be delivered early next year.

A spokesman for the board said the aircraft was being bought to enable the chairman to get about more quickly and to save time and money. Lord Robens often travelled seven days a week to different areas, and this year had spent more than 300 hours flying on business. The aircraft would be based at Luton.

Company Reorganization by Padley & Venables

FOLLOWING the acquisition by Padley & Venables, Limited, group, of all the share capital of Production Tool Alloy Company, Limited, manufacturers of hard metal products, of Sharpenhoe (Bedford), Padley & Venables is creating separate operating companies for the other two businesses in the group, and will itself become a holding company.

P & V (Mining & Engineering), Limited, has been formed to operate the compressed air and mining tool manufacturing side of the business, and directors will be:—Mr. G. A. Morgan, chairman and managing director; Mr. D. U. Foster, secretary and financial director; Mr. E. A. Martin, London director; Mr. B. Swift, buyer; and Mr. D. H. Shute, development director, from Production Tool Alloy Company.

The other new company, Padley Stainless Steels, Limited, will be responsible for the provision and processing of stainless steels in all forms. The directors of this company will be:—Mr. Foster, chairman; Mr. A. Bennett, managing director; Mr. E. Pole, and Mr. Martin.

The holding company board consists of:—Mr. E. W. Senior, chairman; Mr. Morgan, managing director; Mr. T. C. L. Westbrook; Mr. Foster, secretary; who are joined by Major I. M. Floor, and Mr. G. N. Vansittart, of the Production Tool Alloy Company.

CONTRACTS SIGNED FOR SAHARAN NATURAL GAS

CONTRACTS for the sale of natural gas from the Sahara which will be utilized by Britain's gas industry have been signed, the Gas Council announced last week. The natural gas field at Hassi R'Mel, from which the gas will flow, is believed to be one of the largest in the world.

A newly formed French company, Compagnie Algèrienne de Mèthane Liquide (CAMEL), will build and operate a plant at Port Arzew, near Oran, to liquefy the gas, which it will buy from the French producers and sell to British Methane, Limited.

M. Roger Truptil, chairman of the new company, said that the plant will be completed in 1963/64 and will be the first of this type and capacity in the world. It will produce about 1,500,000,000 cu. m. of methane gas a year, in the first stage of which 900,000,000 to 1,000,000,000 cu. m. are earmarked for Britain.

Apprentice of the Year Leaves for Australia

APPRENTICE with the National Coal Board, Norman E. Riley, who recently won the award of Apprentice of the Year sponsored by the British Junior Chambers of Commerce, left for an eight-month visit to Australia last Saturday. Aged 23, he is an electrical engineer from Kiveton Park, near Sheffield, and is the first NCB apprentice to win the award.

During his stay in Australia Mr. Riley will study electrical engineering in all its industrial applications. Returning to that country on the same boat will be Mr. Frank Argus, an Australian, who has spent nine months in Britain after winning a similar award.

ISHRA Holdings

NOW DOWN TO SEVEN COMPANIES

NUMBER of steel and iron companies in which the Iron and Steel Holding and Realisation Agency had direct holdings on September 30 last was seven (including one company in voluntary liquidation), states the agency's annual report, issued last week, for the year ended September 30. When the agency was established in 1953 it had direct holdings in 71 companies. During the year the agency sold privately one subsidiary and the debenture stocks of two companies whose ordinary share capital had been previously sold.

In addition, says the report, 12 prior charge securities of seven companies whose ordinary share capital had been previously sold were disposed of by public offer. Further prior charge securities in three of the latter companies, together with prior charge securities in two other companies, still remain for disposal. The six subsidiaries remaining for disposal are: Bairds & Scottish Steel, Limited; Barrow Ironworks, Limited; Gjers, Mills & Company, Limited; John Baker & Bessemer, Limited; Richard Thomas & Baldwins, Limited; and Skinningrove Iron Company, Limited.

In terms of employment, steel production, and sales of products, the companies which have ceased to be subsidiaries accounted for over six sevenths of the agency's inheritance: Richard Thomas & Baldwins represented over three quarters of the balance remaining with the agency at September 30. In that company the agency held securities valued at £21,000,000 and had made loans totalling £44,000,000.

Cumulative gross realization proceeds to September 30 amounted to £336,900,000, of which £204,700,000 came from 50 companies where the whole of the agency's holding was sold, resulting in an excess of £12,800,000 over book value.

Increase in Sales by British Oxygen

SALES of British Oxygen Company, Limited, in the year to September 30, 1961, rose from £59,700,000 to £62,500,000, but after heavier operating costs and depreciation the profit balance, before tax, fell from £9,500,000 to £8,600,000. After reduced tax of £3,222,941 (£4,439,111), however, there is a net profit, after outside interests, of £4,700,000 against £4,400,000. A final dividend of 6¼ per cent. makes a total of 10¼ per cent. for the year on the increased capital, which is equivalent to the previous year's 16 per cent. total.

The increase in home sales, it is stated, was insufficient to meet additional costs, particularly depreciation charges on new installations not yet fully productive. Results were uneven oversea and below the previous year in total. Costs increased generally and in some countries political and economic influences adversely affected sales.

Top Changes in the Vickers Boardroom

FROM next Monday the managing directorship of Vickers, Limited, passes to Sir Leslie Rowan, who will relinquish his present post as director of finance. He succeeds Maj.-Gen. Sir Charles Dunphie, who in addition to handing over as managing director of Vickers, is also relinquishing his posts as chairman of Vickers-Armstrongs (Engineers), Limited, and chairman of Vickers-Armstrongs (Shipbuilders), Limited.

Sir Charles, however, will continue as deputy chairman of Vickers itself, and as chairman of Vickers-Armstrongs. Sir Charles is also retiring from the chairmanship and from the board of Vickers-Armstrongs (Aircraft), Limited, although he is continuing as director and a deputy chairman of that company's parent, the British Aircraft Corporation, Limited.

Consequent upon the changes at Vickers, Mr. G. H. Houlden is now to be the new chairman of Vickers-Armstrongs (Shipbuilders), while continuing as managing director of that company. Mr. W. D. Opher is appointed chairman of Vickers-Armstrongs (Engineers), while retaining his managing directorship of that company.

Mr. A. H. Hird becomes an assistant managing director of Vickers, Limited, and Mr. R. P. H. Yapp is appointed director of finance and contracts of Vickers, and relinquishes his post as director of administration.

Lancashire Steel Profits Decline

GROUP profit, before tax, of the Lancashire Steel Corporation, Limited, fell from £4,425,713 to £3,737,000 for the year ended September 30, 1961, after an unchanged total charge of £1,500,000 for depreciation and transfer to reserve for replacement of fixed assets.

Net income of £1,532,000 compares with £2,135,713 after taxation of £2,205,000 (£2,290,000), and the total dividend of 11 per cent. is maintained with a final of 7½ per cent.

FORMERLY LOCATED at Prescot, Lancs, BICC-Burndy, Limited, electrical connector specialists, has now become established in its larger premises on the Parr industrial estate, St. Helens (telephone: St. Helens 6251).

Personal

Mr. C. R. Wheeler Heads BSI Export Panel

AS well as becoming deputy chairman of the Associated Electrical Industries, Limited, on Monday, Mr. C. R. Wheeler has just been appointed chairman of the Export Panel of the British Standards Institution, which advises on matters of major policy relating to the Institute's work affecting export trade.

Mr. Wheeler, who also on Monday hands over the presidency of the British Iron and Steel Federation to Sir Julian Pode, is a director of the Steel Company of Wales, Limited, George Wimpey & Company, Limited, and several other companies.

Dr. W. LAYTON, of Durham, has been appointed Lecturer in Geology at Queensland University.

Mr. ERNEST WILBUR, NCB engineer who was closely concerned with the development of Killoch Colliery, near Ochiltree (Ayrshire), and who previously worked on the large-scale modernization of Littlemill Colliery, Rankinston, has retired.

Mr. W. L. HEWLETT is to join Richard Thomas & Baldwins, Limited, on Monday, to advise on problems and activities arising in connection with the possible entry of the UK into the European Common Market. He is at present head of the market division of the Iron and Steel Board.

Ald. HAROLD WATSON, who retired from the coal-mining industry last January after 50 years' service at Middleton Colliery, Leeds, will be Lord Mayor of Leeds in 1962. For 16 years he was secretary of the Middleton branch of the National Union of Mineworkers. His father and grandfather both worked at Middleton Colliery.

Previously managing director of Edwin Danks & Company (Oldbury), Limited, manufacturers of boilers, structural steelwork, etc., of Birmingham, a subsidiary of Babcock & Wilcox, Limited, Mr. L. W. H. REA has been appointed general sales manager of Babcock & Wilcox from next Monday. He succeeds Mr. A. R. CHAPMAN, who is retiring.

New president of the Federation of Manufacturers of Construction Equipment is Mr. J. GOURLAY, joint managing director of Stothert & Pitt, Limited, crane and excavator manufacturers, etc., of Bath (Som). He succeeds Mr. C. H. GRIST, deputy chairman of Blaw Knox, Limited, makers of steelworks and furnace equipment, etc., of London.

Secretary of the Department of Scientific and Industrial Research, Sir HARRY MELVILLE has been appointed a full member of the Research Council (Council for Scientific and Industrial Research). The appointment is "in recognition of his notable services" to DSIR, and does not mean that future secretaries will automatically become members of the Research Council.

Six members of the staff of Humphreys & Glasgow, Limited, contracting engineers, of London, S.W.1, recently received wrist watches in recognition of 25 years' service with the company. They were Mr. S. R. BRIGGS, plant maintenance supervisor; Mr. W. G. BURT, senior construction supervisor; Mr. G. V. C. DAVIES, assistant managing director; Mr. S. A. GLAZEBROOK, chief draughtsman; Mr. E. G. B. GODFREY, design engineer; and Mr. G. W. KITCHEN, supervisor. The chairman of the company, Mr. A. C. CONGREVE, who himself qualifies for an award, was abroad on business and unable to receive it.

New Chairman of ISHRA Appointed

NEW chairman of the Iron and Steel Holding and Realisation Agency is Mr. William Halford Lawson, senior partner in Binder, Hamlyn & Company, chartered accountants. He succeeds the late Sir Herbert Brittain. The appointment, made by the Chancellor of the Exchequer, will be for the period January 1, 1962, to June 9, 1963, in the first instance.

Mr. Lawson, who is 62, is a past president of the Institute of Chartered Accountants. In 1947 he served as a delegate on the Austrian Treaty Commission in Vienna and from 1948 to 1957 was a member of the Transport Arbitration Tribunal. He was a member of the Purchase Tax (Valuation) Committee in 1952 and of the Royal Commission on Local Government in Greater London. He is also a member of the Committee to inquire into Company Law, and of the Southern Electricity Board.

Minister Bans Tin Mine Project in Cornwall

PERMISSION to win and work tin, and for the erection of ancillary buildings at Carnelloe Farm, Zennor, Cornwall, has been refused by the Minister of Housing and Local Government, Dr. Charles Hill, who has overridden a recommendation by an inspector of his department, after a public inquiry last May, that permission should be granted subject to conditions for preserving the amenities.

The proposal put forward by Mr. W. T. Harry, a Cornish mining engineer, was to reopen a tin mine that has lain dormant for 80 years. The Minister considers that the development of the mine and the associated activity would intrude on the natural beauty of the area.

NEW MILL COMMISSIONED AT BRYMBO STEELWORKS

NEW 32 in. by 84 in. cogging mill installed at Brymbo Steelworks, Limited, near Wrexham, a branch of G.K.N. Steel Company, Limited, was commissioned last week when the first ingots were rolled.

With the introduction of the new mill, output from the steelworks is expected to rise to about 5,700 ingot tons a week, compared with the present average of 3,600 ingot tons.

Fuel Oil Injection Tried Out in Scottish Blast Furnace

TRIALS are now being undertaken at the Clyde Iron Works of Colvilles, Limited, of the injection of fuel oil into one of the three pig-iron-making blast furnaces. This is the first time that this method has been used in Scotland.

After the assessment of the new apparatus in the light of running experience, the other Colvilles' stacks at Clyde Iron Works and Ravenscraig will probably be similarly adapted.

MINERS AT Horden Colliery have gained one major and 20 consolation prizes in the Greater Safety Campaign draw organized by the Durham Divisional Coal Board.

Law Cases

PIT SAFETY

Mine Manager's Duty Not "Absolute"

WHILE the manager of a coal mine has the duty to take such steps as may be necessary for keeping secure every working place or road in a mine, he is not a guarantor of the workman's safety, it was ruled in a case before the House of Lords. The duty was to keep the roadway and working place secure in the light of the best obtainable information available to the manager, who must exercise all his engineering skill and care.

The Court unanimously dismissed an appeal by Mr. Frank Hall Brown (39), electrician, who failed in both the lower courts to show that his employer, the National Coal Board, had been in breach of its statutory duty under Section 48 of the Mines and Quarries Act, 1954, when he was injured by a fall from the mine roof at Crofton Mill Colliery, Blyth (Northumberland).

The accident occurred when Brown was working on a fallen girder, to which he had been called on the instructions of the overman, and plaintiff alleged that the NCB had been in breach of its statutory duty under the Act, which provides that "it shall be the duty of the manager of every mine to take . . . such steps . . . as may be necessary" for keeping the road or working place in the mine secure.

Specified Duties

Lord Reid said the plaintiff's case was that the bare fact that the fall occurred was sufficient to show that the manager was in breach of his duty under section 48 of the Act of 1954. That Act largely replaced the Coal Mines Act, 1911.

In place of the old absolute obligation to make the roof and sides of every travelling road and working place secure, the new Act imposed specified duties on the manager personally. If a manager failed to do anything which a careful and skilled manager would have done, he would be in breach of duty and the employer would be liable. The duty, however, was not absolute. All the manager was required to do was to take such steps "as may be necessary" for keeping the working place secure.

A manager could not be in breach of his duty if he had obtained all the information which he was required by Section 48 to obtain, and had acted in the light of that information with all the care and skill which a manager ought to bring to bear.

Viscount Simonds, Lord Radcliffe, and Lord Denning agreed.

Magnets Judgment Reserved

JUDGMENT was reserved in the Restrictive Practices Court on Wednesday of last week in the case to decide whether the price agreement of the Permanent Magnet Association is in the public interest. In his closing speech for the Association, Mr. T. G. Roche, QC, said efficiency resulted from the technical co-operation between members of the association due to the price restriction. The public was getting magnets of improved design, more rapidly and cheaply than would otherwise occur. The PMA prices were quite as low as those abroad.

Mr. Roche said the Association was prepared to give an undertaking that it would not raise the scheduled price—save to reflect increases in costs—and would keep under constant review the possibility of lowering it.

MINER SUES COAL BOARD

AN action brought by Mr. Hugh Donachie, a miner, who was said to have been severely injured when he fell over cables in Newton No. 3 Colliery, failed in the Court of Session. Mr. Donachie, who sued for £8,000 damages, said that in December, 1957, he was carrying hydraulic props to the coalface when he tripped over cables for water and air, which had been left lying about. He blamed the Coal Board for the accident, alleging that it did not operate a safe system of working.

After the evidence for the plaintiff, Lord Milligan directed the jury to return a verdict for the defendants. He said a plaintiff had to present evidence which would be sufficient in law to entitle the jury to find in his favour. He was satisfied the plaintiff in this case had not done so.

£2,000 FOR LOSS OF EYE

CLAIMING damages of £3,000 against Bruntons (Musselburgh), Limited, steel rollers, etc., of Midlothian, for the loss of an eye as the result of an accident during the course of his employment with the firm, Mr. William Quinan was awarded £2,000. On the direction of Lord Kilbrandon, sitting at the Court of Session, the jury found there was no contributory negligence.

Mr. Quinan contended that while removing bands which prevented coils of wire from springing apart, a piece of band struck him about the right eye and cheek with the result that the eye had to be removed. The defendants denied liability and claimed there had been contributory negligence.

£18,000 ACTION AGAINST NCB

AFTER hearing debate in the Court of Session, Edinburgh, in an action by Bridget Calvey or Gallagher (39), and others, against the National Coal Board, Lord Migdale decided to report to the Inner House the question of the form of issue and counter-issue to be put before the jury.

The pursuers are the widow and family of a miner

who lost his life in a fall of stone at Burghlee Colliery (Midlothian) in 1959. They sue for sums totalling £18,450. The NCB denies liability. His Lordship said he would issue a written opinion.

FIFE MINER, John Walton (22), an oncost worker, was fined £15 at Kirkcaldy Sheriff Court for having cigarettes and matches in his possession, underground at Lochhead Colliery, Wemyss.

AT LEEDS ASSIZES, Mr. Justice Winn gave judgment by consent for £1,000 damages and costs against the National Coal Board for Mr. Joseph Howey (48), a collier, who was injured at Hemsworth Colliery in July, 1959.

FORMER apprentice electrician at Hemsworth Colliery, near Pontefract. Christopher Bernard Cornell (18), was awarded £235 damages and costs against the National Coal Board at Pontefract in respect of an injury received in a roof fall.

AT LEEDS ASSIZES, Mr. John McFadyen (52), a miner, was awarded £500 damages and costs against the National Coal Board in an agreed settlement for injuries sustained while working as a coal filler at Markham Main Colliery in December, 1956.

CLAIM FOR DAMAGES against Firth Brown Tools, Limited, Sheffield, by Mr. Norman Singleton (61), sawsmith, who stated he was unable to resume his employment after fracturing his hip at work, was dismissed at Sheffield Assizes. The company was found not to have been negligent.

AGREED SETTLEMENT for £500 damages and costs to Mr. John McFadyen (52), former coal fi' r, against the National Coal Board, in respect of personal injuries received in a fall of roof at Markham Main Colliery, near Doncaster, in 1956, was approved by Mr. Justice Marshall at Leeds Assizes.

DAMAGES of £5,625 were awarded in the Court of Session, Edinburgh, to Mr. David Nugent, craneman, against his employers, George Cohen Sons & Company, Limited, Pollokshaws, Glasgow, a member of the George Cohen 600 Group, Limited, for injuries received when his crane overbalanced.

POSTPONEMENT UNTIL May 7 next, of a hearing in connection with an agreement between members of the Standard Metal Windows Group, was agreed to by the Restrictive Practices Court as the group's accountant witness would be out of the country at the time previously fixed for the hearing, March 12.

CLAIM by a former colliery oncost worker, Mr. Daniel Mitchell (23), for £2,500 damages against the National Coal Board was dismissed by Sheriff R. B. Miller at Campbeltown (Argyll). Mr. Mitchell alleged he received severe injuries through the negligence of the guard of a bogie train used for taking miners from the coal face to the surface at Argyll Colliery, Machrihanish.

Ruhr Mineowners Want ECSC Treaty Revised

TO enable the Ruhr pits to have a unified sales organization, the Ruhr Mineowners' Association has called for a revision of the European Coal and Steel Community treaty. Under the present anti-cartel terms of the treaty, the Ruhr pits have three sales organizations.

It is reported that West German unsold coal stocks at the end of November were 12,300,000 tons, or 1,300,000 tons more than at the same time last year, and that since 1958 about 138,000 West German coal miners (about one fifth of the total) have been dismissed during rationalization measures.

Appointments

Undermanager Change in West Midlands NCB

LATEST appointment in the No. 4 (Warwickshire) Area of the West Midlands Divisional Coal Board is that of Mr. C. O. Lees, who is now undermanager of Binley Colliery, near Coventry. For the last five years he has held a similar appointment at Newdigate Colliery, near Nuneaton, in the same Area.

Mr. Lees began his mining career in the East Midlands Division and moved to Newdigate Colliery in 1936, where he remained for 11 years, becoming overman and assistant undermanager. Subsequently he spent five years as night undermanager at Coventry Colliery, before returning to Newdigate.

Mr. F. H. BEASANT has been appointed manager (traction) of Brush Electrical Engineering Company, Limited.

Dr. I. FELLS, lecturer in fuel technology and chemical engineering at Sheffield University, has been appointed Reader in Fuel Science in the Newcastle division of the University of Durham.

Mr. L. W. H. REA, previously managing director of Edwin Danks & Company (Oldbury), Limited, a subsidiary of the Babcock organization, is appointed as general sales manager of Babcock & Wilcox, Limited, with effect from Monday, in succession to Mr. A. R. Chapman, who is retiring after 16 years' service in that postion. Mr. J. H. WORLLEDGE has been appointed secretary of Babcock & Wilcox in succession to Mr. L. W. Cole, who is director in charge of group financial control.

Pit Recruitment in the Scottish Coalfield

SPOKESMAN for the Scottish Division of the NCB said last week that Mr. Alex Moffat, president of the Scottish Area of the National Union of Mineworkers, quoted incorrect figures on youth recruitment at a recent conference of young miners in Edinburgh. Mr. Moffat said that only 200 youths under 18 were recruited in Scotland in 1959, and 570 in the next year. The spokesman said: "Over 900 youths under 18 were taken on during 1959. The next year the figure rose to over 1,800."

The young miners had been told that the drop in recruitment had led to a lack of confidence in the industry. In the 12 years between 1947 and 1959, the Coal Board recruited between 2,000 and 3,000 youths each year.

Mr. Moffat also said that the Scottish Area of the NUM would continue to press for a public inquiry into the management of the coal industry in Scotland at the union's national conference in July.

DETAILS of the second of the two major projects of the Department of Scientific and Industrial Research, recently foreshadowed by the Government, will, it is hoped, be announced in the New Year, said Mr. Denzil Freeth, Parliamentary Secretary, Ministry of Science. The first project, announced two weeks ago, is a development contract for a machine to grind large gears. It was awarded to Craven Bros. (Manchester), Limited.

FRENCH STEEL MARKET

Production Cut to 90 Per Cent. Capacity

[*From Our Special Correspondent*]

THOUGH on the whole orders received in recent weeks by the French steel mills have been above their September level, the increase has not been substantial enough to maintain steel production at its previous full-capacity rate, and steelmakers are adjusting production to the level of order-books to avoid see-saw effects on the activities of the mills. Production rate is now estimated to be at about 90 per cent. of capacity, and steel production for the year is therefore expected to reach about 17,700,000 metric tons against the 18,000,000 tons set under the Third Plan for the industry.

Orders have been arriving at a satisfactory rate for bars, concrete reinforcing bars, and heavy plate, while the market for sheet still shows a lack of firmness. On the other hand, joists, angles, and T and U bars remain in high demand, reflecting the continuing expansion in steel fabrication. Orders for special alloys, mainly wire rod, semi products for forging, as well as bars, are satisfactory.

The situation does not seem alarming to steelmakers who point out that activity of most of the steel-using industries has been rising faster than orders for steel placed by these industries. As further progress is announced for 1962, and with stocks coming gradually down to their minimum security level, the market is expected to pick up again by the coming spring. Indications received from the United States seem to confirm that a more favourable trend is also likely to affect the market for steel exports to the US.

Steelmakers further point out that the previous 100 per cent. capacity production rate is no longer expected to be reached under normal market conditions, as has been the case up to July. This situation, which is due to the lack of elasticity of productive capacity of French mills, has resulted in difficulty in supplying customers whenever the economy enters a boom period. The industry has for many years sought a margin of capacity sufficient to enable it to face without delay a sharp rise in demand, but this margin has so far been provided only on a narrow basis as a result of inadequate finance. The Fourth Plan, which comes into effect next year, has confirmed the necessity of allowing for a margin in productive capacity of about 10 per cent.

Japan to Free Imports

APPROVAL of a plan to free imports of 170 items from December 21 has been announced by the Japanese Government. At the same time it has decided to apply this liberalization measure to all countries, thus withdrawing a previous proposal to withhold the benefits of liberalization from four West European nations, the UK, France, Italy, and Austria.

The items to be liberalized include:—Stainless steel, high-carbon steel, high-carbon spring steel, construction machinery, mining machinery, and certain types of machine tools.

Slow-down in Austrian Steel Expansion

STEEL industry in Austria is beginning to feel the first effects of the recession in European steel markets, the changing trend being reflected in the falling rate of new orders being placed with steelmakers and in the temporary closure of two blast furnaces and two open-hearth furnaces at Alpine-Montan, and Vöest, the two major steel concerns. Orders on hand at October 1 this year were 22 per cent. lower than a year earlier, while new orders received during the nine months' period declined from 1,520,000 tons of rolled products to 1,390,000 tons.

On the whole, this setback has so far been confined to the domestic market. Home demand for sheet dropped by 22 per cent. from 158,000 tons to 122,000 tons and for plates by 14 per cent. from 177,000 tons to 152,000 tons. Foreign sheet orders, on the other hand, fell by only 5 per cent. from 424,000 tons to 402,000 tons, while demand for plates increased from 246,000 tons to 250,000 tons. The volume of export sales has only been maintained, however, at the cost of substantial price concessions. Mr. Koller, managing director of Vöest, recently stated that as a result of falling prices, sales will not reach the 1960 level.

It is already clear that, after the best year ever, 1961 will mark a pause in Austrian steel expansion. Crude steel output last year rose by more than 25 per cent. to 3,160,000 tons, whereas the rate of growth during the first nine months of this year was only 1.3 per cent.

EUROPEAN SCRAP FOR EXPORT

AT the recent meeting in Amsterdam of the Scrap Iron and Steel Section of the Bureau International De La Recuperation (BIR), delegates from France, Belgium, Holland, Italy, Switzerland, Britain, and West Germany, were told that certain quantities of scrap were available for export.

The national governments and the High Authority of the ECSC are to be informed of the present selling difficulties and requested to consider exports to third countries. This is particularly the case for the disposal of blast-furnace scrap.

Concerning the EEC countries, Mr. Renier (Belgium) indicated that liberations of scrap took place. The partners in the EEC agreed amongst themselves on export-quotas for the third and fourth quarters.

Board Changes

New General Manager of Richard Sutcliffe

MR. A. W. HILL

DIRECTOR and works manager of RICHARD SUTCLIFFE, LIMITED, mining machinery and mechanical handling equipment manufacturers, of Horbury (Yorks), Mr. A. W. Hill has been appointed general manager of the company in succession to Mr. M. R. Moore, who has been appointed managing director of Sutcliffe Plant Hire, Limited, Wakefield. The changes take effect on Monday.

Mr. Hill joined Richard Sutcliffe in 1946 and after serving as fitting shop foreman and works superintendent, was appointed works manager in 1958. He is an associate member of the Institution of Works Managers.

LODGE-COTTRELL, LIMITED—Mr. H. G. Trevor Busby has been appointed managing director.

REDPATH, BROWN & COMPANY, LIMITED—Mr. W. F. Hutchinson and Mr. W. Moore have retired from the board and do not seek re-election.

S. GUITERMAN & COMPANY, LIMITED—Mr. Leopold C. Cogan has been appointed a director. Mr. Frank E. Oldham has resigned from the board.

GREENOCK DOCKYARD COMPANY, LIMITED—Mr. A. Paxton will become joint managing director from next Monday, and Mr. J. J. Swan, who is secretary of the company, will become a director.

BELLING & LEE, LIMITED—Dr. A. C. Robb, formerly technical manager, has been appointed technical director, and Mr. J. R. Turrill, formerly sales manager, has been appointed sales director.

W. J. FURSE & COMPANY, LIMITED—Mr. John K. Furse has been appointed sole managing director, and Mr. Peter M. Furse assistant managing director, with effect from January 1. Mr. Sydney J. Furse remains chairman.

S. N. BRIDGES & COMPANY, LIMITED—Lord Aberconway, Mr. R. J. Barclay, Mr. W. H. Bateman, Mr. A. Grieve, and Mr. A. N. E. McHaffie have resigned from the board, following the acquisition of the company by Staveley Works (Great Britain), Limited.

YOUNG ACCUMULATOR COMPANY, LIMITED—Mr. A. S. Duncan, director and general manager of the company, a subsidiary of Crompton Parkinson, Limited, leaves soon for India to take up a senior position with Crompton Parkinson's interests there. He will be succeeded at Young Accumulator by Mr. W. G. Nevill.

T. & T. VICARS, LIMITED—Mr. J. Barratt has been appointed technical manager, and Mr. T. Tindale production manager. Mr. Tindale succeeds Mr. G. E. Haywood, who has become a director of Henry Simon (Engineering Works), Limited. Both companies are members of the Simon Engineering, Limited, group.

HENRY SIMON (HOLDINGS), LIMITED—Mr. C. G. Ahlquist, a director of Henry Simon, Limited, and head of its container machinery and coating plant departments, and Mr. J. V. Goddard, assistant managing director of Simon Handling Engineers, Limited, are to become directors of the holding company on January 1.

MARTIN BLACK & COMPANY (WIRE ROPES), LIMITED—Mr. J. R. Hendry has been co-opted to the board and has become chairman. Mr. A. D. Martin and Mr. W. S. Black, joint managing directors, become in addition deputy chairmen. Mr. J. Goodlet has resigned as secretary and executive director and becomes a full director, with the position of assistant managing director. Mr. G. A. Black, Mr. W. Douglas, Mr. W. Holloway, jun., Mr. A. Johnson, and Mr. R. G. Sewell have been appointed executive directors and become full members of the board. Mr. T. E. Osborne becomes secretary, and Mr. R. B. Dunlop, chief accountant.

Sir Julian Pode is BISF's New President

DEPUTY chairman and managing director of the Steel Company of Wales, Limited, Sir Julian Pode is to succeed Mr. C. R. Wheeler as president of the British Iron and Steel Federation on Monday. The BISF council intends to appoint Mr. Graham Stewart, chairman and general managing director of Stewarts and Lloyds, Limited, as president-elect of the federation for 1962.

Sir Julian, who was appointed deputy chairman of SCOW last May, is to become chairman of the company when Mr. Harald Peake vacates that office after the next annual meeting on February 5. Sir Julian has been a member of the council and the executive committee of BISF since 1945, and is chairman of its Price Policy Committee.

Mr. Stewart was president of BISF in 1955, and has been a member of the Federation's council, and of its executive committee, since 1945, in which year he was appointed chairman and managing director of Stewarts and Lloyds.

Recent Wills

HALFORD, HAROLD, commercial manager for the last 15 years of Arthur Lee & Sons, Limited, makers of hot and cold rolled strip, etc., of Sheffield ... £10,924

MORRIS, W. G., a former chairman of Greengate & Irwell Rubber Company, Limited, manufacturers of electric cables and wire, of Manchester, who began work with the company in 1901, and retired in 1953 ... ... £52,900

WATSON, JOHN, managing director of Alex. Findlay & Company, Limited, boilermakers, etc., of Motherwell (Lanarkshire), director of Furness Shipbuilding Company, Limited, and Sears Engineering, Limited £137,259

INNES, JOHN, former managing director of Cable & Wireless, Limited, and joint deputy secretary to the Ministry of Fuel and Power, director 1950-59 of the Telegraph Construction & Maintenance Company, Limited £21,075

HENSHAW, SAMUEL, chairman of the National Benzole Company, Limited, from 1919-42, and a former director of the Staveley Coal & Iron Company, Limited, Yorkshire Main Colliery (1923), Limited, and other companies £90,624

HOLT, L. D., retired shipowner, for many years a director of Caledon Shipbuilding & Engineering Company, Limited, member of the Coal Mines Reorganization Commission, 1931, Lord Mayor of Liverpool, 1929-30 ... ... £163,705

BRAINTREE, LORD, chairman of the Crittall Manufacturing Company, Limited, metal window manufacturers, of Braintree (Essex), the Darlington & Simpson Rolling Mills, Limited, and a former director of the Bank of England £38,666

IRON AND STEEL TRADE

SALES staffs of the big steel firms are struggling to maintain orders for heavy finished products and semi-finished materials so that the rolling mills can be kept going, even on their present short-time schedules. Many are uncertain whether they will succeed against a background of falling demand which is accentuated by the customary seasonal decline. Outputs of crude steel are expected to be curtailed at least during the first three months of 1962.

Pig-iron

There is little change in the situation so far as pig-iron producers are concerned. They would welcome increased demands in all sectors.

Deliveries to both steelworks and foundries could be stepped up appreciably from the supplies which are now available.

Semi-finished Steel

The trading position at the re-rollers remains uncertain and only a modest demand is being made for their products. There is little if any improvement in the call for small bars, light sections, and strip, while the demand for reinforcing rods has fallen off.

The steelworks have been unable to dispose of available tonnages of steel semis for some time past and at present there are no signs of any improvement.

Finished Steel

The English mills have resumed work after the Christmas break but the Scottish mills have their break to look forward to. Consumer demand is still meagre and hopes are now fixed on the New Year.

Makers of colliery requirements are finding demand much below normal due to the Coal Board's efforts to reduce existing stocks, and further indents would be most acceptable.

Iron-ore Imports

IMPORTS of iron ore and concentrates (except chrome iron ore) and roasted iron pyrites in November, and the totals for the first 11 months of this year and last, are shown in the table below.

From	Month ended Nov. 30	Eleven months ended November 30	
	1961.	1960.	1961.
	Tons.	Tons.	Tons
Sierra Leone	35,670	684,156	511,263
Canada	92,970	3,236,617	2,279,242
Other Commonwealth countries and Eire	17	24,500	9,605
Sweden	369,754	4,330,426	4,419,980
Norway	7,100	324,551	234,803
France	37,709	524,466	431,642
Portugal	8,782	351,012	142,250
Spain	58,386	704,870	675,016
Algeria	126,580	1,920,473	1,406,915
Tunisia	31,731	641,636	434,970
Morocco (including Tangier) ..	19,210	717,038	469,966
Liberia	—	495,880	402,459
Venezuela	75,525	1,487,078	1,584,545
Brazil	47,858	571,852	527,043
Other foreign countries	59,899	725,184	578,875
TOTAL	971,191	16,739,739	14,108,574

Japanese Concern Over Goan Iron Ore

JAPANESE steel manufacturers have been discussing the possible effects of recent developments in Goa, which has supplied Japan with about 10 per cent. of its iron-ore requirements. Imports of ore from Goa this financial year had so far amounted to about 1,100,000 tons. Japanese steelmills have invested nearly £500,000 in the modernization of port facilities in Goa to speed shipments of iron ore to Japan.

Goa had also become West Germany's most important Asian source of iron ore, it was stated, and last year's imports of more than 12,200,000 tons represented 8 per cent. of West Germany's iron-ore imports.

Allied Ironfounders and Common Market

SALES organization of Allied Ironfounders, Limited, is being strengthened to allow a detailed study to be made of the company's prospects in the Common Market and to expand its existing continental sales. Mr. Charles Insch has been appointed European sales and product development manager, and is being released from his other duties.

Mr. F. Moffat has been appointed to the new post of general sales manager, with duties chiefly involving sales force administration. Mr. V. Keith will become his assistant.

Murex Half Year Profit Falls 10 Per Cent.

GROUP sales of Murex, Limited, the metallurgical group, fell by 3 per cent. in the six months ended October 31, 1961, compared with the corresponding period of 1960, and group net profits were 10 per cent. lower, reflecting reduced operating margins and higher profits tax. The group profits, however, were in line with those for the preceding six months to April 30, and the interim dividend is maintained at 5 per cent., a payment followed previously by a final of 8 per cent.

The board reports that a declining demand for ferro-alloys and metals for the steel industry was partly offset by increased sales of special alloys and welding electrodes. Since October, the "modest decline" has continued and present indications are that the group trading results for the year will not reach those of the two preceding years.

HAVING THIS year outstripped the Tyne as Britain's biggest coal-shipping port, Blyth has broken its own coal-shipping record. Up to last Saturday night, coal shipments from Blyth were 6,801,364 tons, compared with the previous best figure of 6,788,266 tons in 1936. In the last few days of this year another 70,000 tons are expected to be shipped.

New Safety Drive Urged in Industry

LAST year's figures of 190,000 industrial accidents in Britain, including 675 fatal accidents, were the highest for 10 years, said Lord Mills, Minister without Portfolio, in Birmingham last week. He was opening new offices for the Birmingham and District Industrial Safety Group.

LORD MILLS

Lord Mills, former Minister of Power, said the figures represented much human suffering and a wholly indefensible waste. To reduce the number of accidents, the first essential was that everyone in industry should take safety much more seriously. A sustained effort was needed by employers, workers, and Government. The factory inspectorate had increased in recent years, but factory law and its enforcement could not be the complete answer. During 1960, 65 per cent. of accidents reported were due to causes for which human faults were to blame.

He commended the initiative of the 400 companies which comprised the Birmingham industrial safety group, whose training centre had set the pattern for similar smaller centres in Liverpool, Edinburgh, and Cardiff. The Birmingham centre was opened in 1956.

Assessment of Explosives

TESTING of explosives, with special reference to the ability of a test to indicate the presence of significant difference in ignition probability and also to the reliability of the test, is discussed in "On the Influence of the Permitted Ignition Rate in the Assessment of Explosives," by H. T. Ramsay and J. S. Seager (SMRE Research Report No. 209), available from the Safety in Mines Research Establishment, Ministry of Power, Portobello Street, Sheffield 1 (price 1s. 9d.).

It is suggested that tests requiring low ignition rates, and particularly no-ignition tests, are, as a class, poor discriminators. The ability to discriminate can be increased by increasing the number of ignitions accepted as the pass level. It is suggested that a test of 26 shots, in which 13 ignitions are permitted, represents a good compromise, in view of the need to keep the number of shots within reasonable limits.

WITH ONLY 24 hours to go before the gala opening of Billy Smart's Christmas circus season at Leeds, last week, Crofts (Engineers), Limited, which has a Leeds office opposite the hall where the circus is taking place, agreed to try to replace a vital piece of missing equipment for one of the aerial acts. Using a rough description by the two artists (who speak very little English), Crofts undertook to try and make a replica of a swivel bar in time for the opening show.

Obituary

MR. D. F. PEXTON

MARKETING director of the South-Western Divisional Coal Board from 1958 until his retirement in October, Mr. DUDLEY F. PEXTON died on Boxing Day. After service with the Carlton Collieries Association, he joined Stanton Ironworks Company, Limited, in 1935.

Following a period of secondment to BSN Coal Sales, Limited, from 1943 to 1945, he returned to Stanton Ironworks as coal sales manager and fuel buyer. Joining the East Midlands Division of the NCB in 1947, he was appointed marketing manager in 1952.

Full-time agent for the National Union of Mineworkers in the Fife district, Mr. JOHN SUTHERLAND died recently at the age of 53.

Mr. TOM CHANDLER, chairman and managing director of Whitby & Chandler, Limited, rubber and asbestos manufacturers, of Sheffield, has died at the age of 72.

Founder and managing director of S. Rhodes & Company, Limited, iron and steel scrap merchants, of Sheffield, Mr. SYDNEY RHODES died recently at the age of 70.

Mr. JAMES N. CAIRNS, who has died at the age of 56, was for a number of years export manager of Smith & Wellstood, Limited, makers of stoves and ranges, etc., of Bonnybridge (Stirlingshire).

Mr. SAM HADFIELD, for 50 years representative in the Birmingham and Leicester areas for the foundry supplies department of Thos. W. Ward, Limited, Sheffield, has died at the age of 78. He retired from the company in 1958.

The death has occurred, at the age of 69, of Mr. GORDON KILNER, who, until his retirement, was a mining engineer on the staff of Hardypick, Limited, manufacturers of mining tools, and drilling machinery, etc., of Sheffield.

A memorial service for Mr. FRANK THOMPSON-SCHWAB, chairman of Balfour & Darwins, Limited, the steel manufacturing group, was held at the Grosvenor Chapel, South Audley Street, London, on Tuesday of last week.

The death has occurred, at the age of 69, of Mr. JOHN BURROWS, a retired coal inspector, who had worked in Nottinghamshire and Derbyshire mines for 45 years. He left Moorgreen Colliery in 1944 to work as an inspector on open-cast sites.

Mr. CHARLES LYALL MASON, former director of Cammell Laird & Company, Limited, and former managing director of the company's Sheffield steelworks, has died at the age of 82. Mr. Mason retired from the Cammell Laird board in 1956.

Founder of E. S. Shillito, Limited, shear manufacturers, of Sheffield, Mr. EDWARD STANIFORTH SHILLITO died last week at the age of 60. He began as a one-man business in 1931 by renting for 1s. 6d. a week a small part of the present Hanover works in Sheffield.

Employed for 50 years as a toolmaker by the Welsh Tinplate & Metal Stamping Company, Limited, Llanelly (Carm), and for many years before his retirement foreman in charge of the firm's fitting shop, Mr. WILLIAM JAMES THOMAS has died at the age of 80.

The death has occurred of Mr. ARTHUR ERNEST POCOCK, a founder partner of Lloyd Bros. & Company, wire and sheet metal workers, of Newport (Mon). He was 69. Mr. Pocock founded the business with his brother, the late Mr. Richard Pocock, in 1919.

Some Metallurgical Features of

STEEL CAST CONTINUOUSLY IN THE WEYBRIDGE MULTIPLE MOULD

by

G. LITTLEWOOD and **W. H. PRITCHARD**
(BISRA Steelmaking Division) **(Continuous Casting Company, Limited)**

The most recent innovation in the rapidly expanding field of the technology of continuous casting has been the introduction of a multiple cavity mould (the Weybridge process). A description of the process and trials using a mould having three 3-in. square connected cavities has been given by Savage and Pearson (IRON AND COAL, April 7, 1961, pp. 725-728). The multiple ingots thus produced were easily parted by oxy-acetylene burners and representative pieces of the ingots were rolled. This report describes the metallurgical features of the rolled products from two of the ingots produced during the above-mentioned trials.

INGOTS investigated in this report were the fifth and tenth to be cast in a series of 11; some of the more important casting details are shown below.

Tapping temperature, 1,600 deg. C.
Casting temperature, 1,520 deg. C.
Mould cooling water rate, 250 gal./min.
Mould cooling water temperature rise, 8 deg. C.
Lubrication, rape seed oil at 40 cc./min.
Tundish pre-heat, 1,490 deg. C.
Tundish nozzle, $\frac{3}{8}$-in. dia. fireclay.
Casting speed, 3 ft./min.

Cutting Trials

The ingots were parted by oxy-acetylene torches. A cutting speed of 13 in./min. was attained on the cold ingots, but as this was a preliminary investigation this figure is probably much lower than the optimum. Fig. 1 shows the process in operation. The slight amount of oxidized flash on the underside of the cut was easily removed by a swing grinder before rolling.

Rolling Procedure

Pieces approximately 2½ ft. long were cut from the centre of the now individual ingots, the length chosen being slightly different to facilitate identification after rolling. The pieces were then rolled to 1¼-in. dia. round bars by a member firm, as follows.

The pieces were not dressed, apart from the

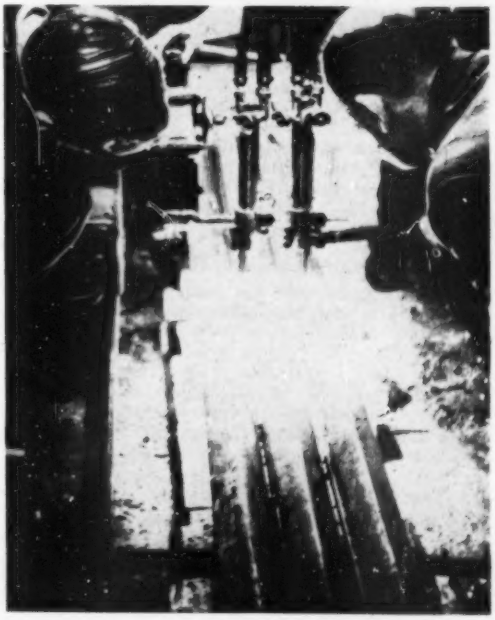


FIG. 1.—FLAME CUTTING OF MULTIPLE INGOTS.

TABLE 1.—*Percentage Composition of Ingots.*

	C	S	P	Si	Mn	Al
Ingot No. 5.	0.34	0.013	0.025	0.22	0.85	0.03
Ingot No. 10	0.33	0.025	0.050	0.17	0.71	0.02
En 5 Spec.	0.25 to 0.35	0.06 max.	0.06 max.	0.05 to 0.35	0.6 to 1.0	—

grinding described above and were re-heated to 1,050 deg. C. in an oil-fired pre-heating furnace for the standard time for this size and quality of billet. They were then reduced through 13 passes in a small hand-fed mill, alternating from square to diamond passes and finishing in a round. The section slightly overfilled the gap on the last pass, resulting in two small marks diametrically opposite on the finished bar. Since there were two such marks on each bar, this could not in any way be correlated with the flame-cut edge and closer examination of the pickled bars confirmed this view. No other defects were found on the finished bars.

Hot Upsetting Tests

Nine 2-in. long slugs were cut from the 1⅛-in. dia. bars, and upset forged at about 1,000 deg. C.

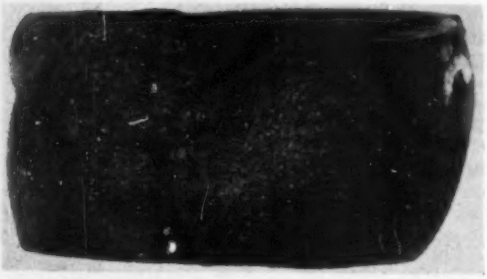


FIG. 2.—SKIN BURSTING ON HOT-UPSET ROLLED BAR.

to ¼-in. thick discs. Only one of the samples showed any skin bursting and pickling was necessary to reveal this. The nature of this bursting is shown in Fig. 2. Step machining tests did not reveal any sub-surface defects on the rolled bars.

Mechanical Tests

Several lengths were cut from about the middle of each 1⅛-in. dia. bar, normalized at 870 deg. C. for 1½ hr., and machined into standard tensile and impact specimens. The results of these tests are collated in Table 2, and compared with the BS Specification for En 5 steel. Specimens B and Y were from the centre sections and samples A and C, and X and Z from the two outer sections of the original multiple ingots. It can be seen that no significant difference exists in the properties in the various parts of the ingot and that all the properties exceed those laid down in the BS 970 specification. The lower impact values of ingot 10 are probably associated with higher phosphorus content of this cast.

Macro and Microstructure

Figs. 3 and 4 show the appearance of sulphur prints and sections etched with ammonium persulphate in the transverse and longitudinal directions of one of the multiple ingots. The chill zone is delineated by the apparently low sulphur areas and it can be seen that the web joining the sections is entirely a chilled structure. There is actually no variation in the sulphur content from surface to centre; the apparent difference being caused by the size of the sulphide particles being smaller in the chill zone.

The "V" segregation of the sulphur is shown in both illustrations and some slight central porosity can be seen in one of the end ingots.

No cracks or other defects were found in the webs joining the ingots.

A large number of pieces from the 1⅛-in. dia. bars were sectioned in the longitudinal and transverse directions. Fig. 5 shows representative sulphur prints of the sections and Fig. 6 shows the effect of etching these in copper ammonium chloride. This etchant was used to reveal the degree of "banding" common in this class of steel by preferentially attacking the phosphorus and sulphur rich areas. Although there is apparently some segregation of these elements in the centre section of the multiple ingot, indicative of slower

TABLE 2.—*Results of Mechanical Tests*

Specimen No.	Original dia., in.	Percentage reduction in area.	Yield stress, ton/sq in.	Maximum stress, ton/sq in.	Breaking stress, ton/sq in.	Percentage elong.	Izod imparts, ft. lb.			Izod average, ft. lb.
							1	2	3	
A_1	0.399	63.20	26.48	39.60	78.70	32.03	72	—	74	73
A_2	0.399	63.20	26.24	39.04	78.04	28.13	68	74	66	69
A_3	0.396	62.60	25.20	39.02	76.74	28.91	74	60	52	62
B_1	0.399	61.60	25.20	38.48	75.00	31.25	72	73	73	73
B_2	0.399	64.00	20.96	38.00	77.11	33.59	62	74	70	69
B_3	0.399	64.80	26.48	38.80	80.00	30.47	64	73	74	71
C_1	0.399	63.60	26.64	40.56	80.00	26.56	76	60	75	70
C_2	0.399	60.80	26.80	39.84	74.90	28.91	65	63	70	66
C_3	0.399	60.00	26.56	39.20	73.60	28.91	69	76	57	67
X_1	0.399	58.40	24.16	37.76	69.81	29.69	43	42	44	43
X_2	0.399	58.40	26.56	38.96	73.08	31.25	58	51	61	57
X_3	0.399	59.20	24.80	37.76	72.16	28.13	51	52	49	51
Y_1	0.399	59.20	25.20	38.00	71.77	28.13	41	45	48	45
Y_2	0.399	57.60	26.80	38.88	71.51	25.78	43	44	52	46
Y_3	0.399	58.40	23.84	38.32	71.92	25.00	45	48	52	48
Z_1	0.399	61.60	26.24	38.64	79.58	31.25	42	52	42	45
Z_2	0.399	58.40	25.28	38.24	70.96	26.56	59	36	48	47
Z_3	0.399	57.60	26.96	39.04	71.89	28.91	47	47	46	47
En 5 Spec.	0.399	—	16.00	32.00	—	25.00	—	—	—	20

NOTE.—All tensile specimens have original gauge length of 2 in. Average hardness were as follow:—Ingot 5, 175 BHN, Ingot 10, 175 BHN, the values specified in BS 970 being 143 to 193 BHN.

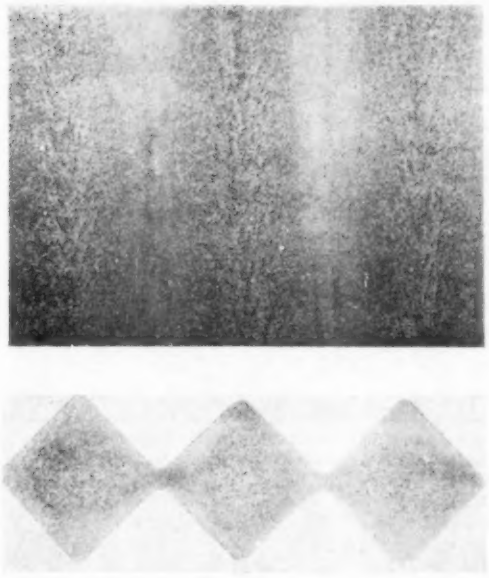


FIG. 3.—PHOTOGRAPHS OF SULPHUR PRINTS, MID-LONGITUDINAL AND TRANSVERSE INGOT SECTIONS. (×¼.)

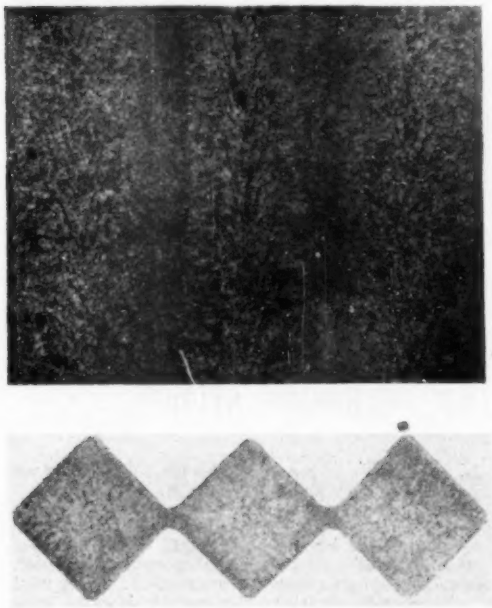


FIG. 4.—PHOTOMACROGRAPHS OF MID-LONGITUDINAL AND TRANSVERSE INGOT SECTIONS ETCHED IN AMMONIUM PERSULPHATE. (×¼.)

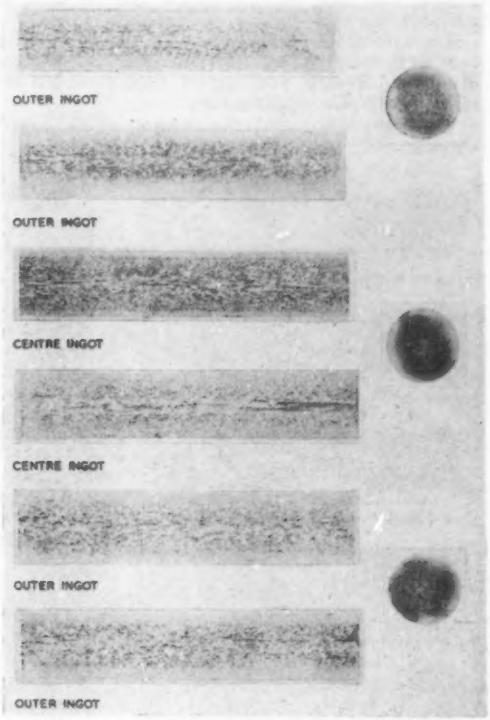


FIG. 5.—PHOTOGRAPHS OF SULPHUR PRINTS OF ROLLED BARS.

cooling or a greater degree of superheat, this has no influence on the mechanical properties.

Drillings were taken along the axes of several of the bars with a ¼-in. dia. drill. The sulphur and phosphorus content was identical with the bulk analysis of the ingot material, indicating that this segregation is an etching and/or structural effect rather than a real variation in composition.

Fig. 7 shows, in transverse and longitudinal directions, the microstructure of the normalized bars, which is typical of conventional material. The slight amount of banding is clearly shown in the lower photomicrograph.

Fox inclusion counts on these bars showed a slightly greater content of nonmetallic matter in bars from the centre ingot, *i.e.*, 136 compared with 118 for the outer ingots, but both values are considered normal for the steelmaking process used. The austenitic grain size of 5 to 6 on the ASTM scale was also considered normal for this quality of steel.

Conclusions

This work has shown that the multiple ingots produced by the Weybridge process can be separated without harmful effect by oxy-acetylene torch cutting. Parting by means of shaped rolls is standard practice in some works and there is no

reason why this method should not be used on multiple ingots.

The individual ingots were very similar in structure and rolled down to 1¼-in. dia. bar without difficulty. Tensile and impact tests exceeded the relevant BS 970 specification.

It is concluded that the process yields sound, commercially acceptable steel.

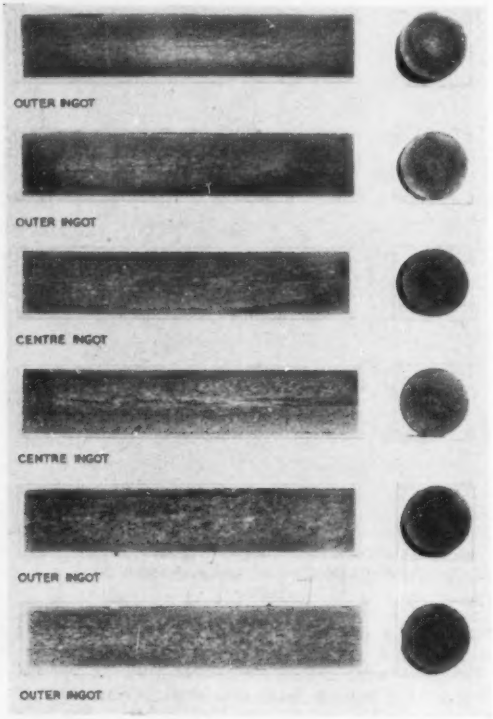


FIG. 6.—PHOTOMACROGRAPHS OF MID-LONGITUDINAL AND TRANSVERSE SECTIONS OF ROLLED BARS ETCHED IN COPPER AMMONIUM CHLORIDE.

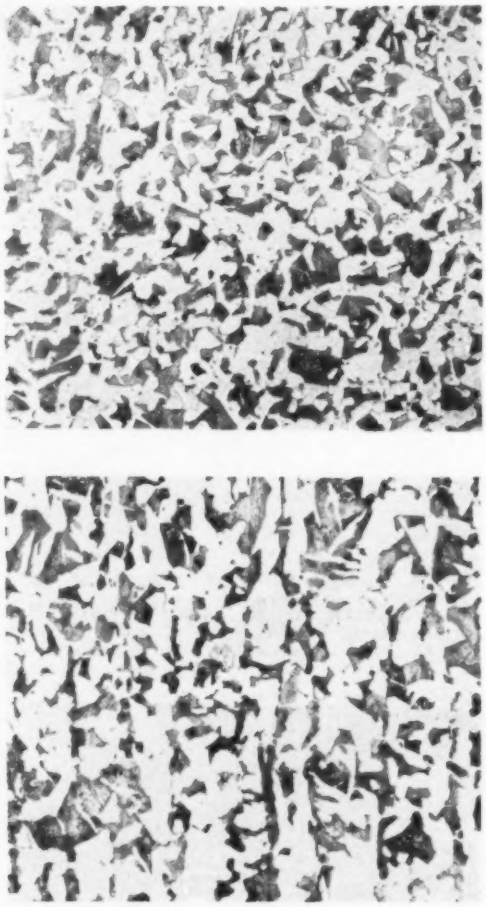


FIG. 7.—PHOTOMICROGRAPHS IN TRANSVERSE AND LONGITUDINAL DIRECTION OF NORMALIZED ROLLED BAR ETCHED IN 2 PER CENT. NITAL. (×150.)

RECORDING SOIL PROFILES FOR CORROSION STUDIES

IN studies of the effects of corrosion on buried metals it is necessary to open trenches periodically to examine the specimens and the surrounding soil.

Until recently, in recording the results of his examination, the pedologist had to write a long and detailed description of the soil profiles on the spot, while the trench was open. This record was usually supported by black and white photographs. This process was exceedingly laborious, and the photographs were rarely of any practical value.

In an attempt to overcome the limitations of black and white photographs, the British Iron and Steel Research Association, as part of an investigation into the corrosion of buried metals, experimented with three-dimensional colour photographs of soil profiles.

With the aid of relatively inexpensive equipment, colour stereophotographs were obtained which were so outstandingly successful that only brief notes were needed on the site to provide enough information for the compilation of a full pedological analysis at a later stage.

FRICTION WINDERS at Dawdon Colliery

A Study of the Engineering Aspects

*by D. L. HUNT, B.Sc.(Eng.)**

The coal winder at the Theresa shaft and the man/service winder at the Castlereagh shaft, Dawdon Colliery, Durham Divisional Coal Board, were commissioned during July, 1960. The design and installation of these winding engines is described in this paper, together with interesting features considered worthy of special comment. The performance of this equipment has raised some controversial points on friction winder design and operation. The paper was presented to the North of England Branch of the National Association of Colliery Managers on March 22, 1961.

DAWDON COLLIERY is situated on the cliff top a short distance from Seaham (Co. Durham). The colliery with its two shafts, Castlereagh and Theresa, is about 60 years old and, prior to Vesting Day, was owned by Londonderry Collieries, Limited.

Some years ago a large reconstruction scheme was put in hand with the object of raising the output of coal from 700,000 ton/annum to some 900,000 ton/annum. One part of this reconstruction scheme necessitated larger and more efficient winding engine equipment. Before the reconstruction scheme the Theresa upcast shaft and the Castlereagh downcast shaft were each served by a steam-driven 20-ft. dia., 10-ft. wide single-drum winding engine with a maximum rope speed of 60 ft./sec. Each winder was fitted with two cages in balance, running in rope guides in the Theresa shaft and rigid wooden guides in the Castlereagh shaft, and fitted with a balance rope. The Theresa winder wound coal, men, and materials to the Low Main level. The Castlereagh winder wound coal, men, and materials to the Hutton level (1,637 ft.) and men and materials to Low Main (1,492 ft.) and Five Quarter levels (1,219 ft.). The Theresa cages each carried eight tubs on two decks giving a coal payload of 3.65 tons and a maximum output of 173 ton/hr. from the Low Main level. The Castlereagh cages each carried 12 tubs on two decks giving a coal payload of 5.45 tons and a maximum output of 218 ton/hr. from the Hutton level. The Theresa and Castlereagh cages could each hold 56 men and 84 men, respectively, on two decks, but in practice only one deck was used.

* Plant Applications Engineering Department, Heavy Plant Division, Associated Electrical Industries, Limited.

It was decided to remove the existing steam-winding engines from both these shafts and replace them with four-rope tower-mounted friction winders. Both shafts are about 1,600 ft. deep and the choice of friction winders for such a duty has often been viewed with scepticism. The decision to instal tower-mounted friction winders was made by the National Coal Board in the early stages of colliery reconstruction planning. The factors that influenced this final decision were:—(*a*) the estimated overall low cost and the problem of limited space; and (*b*) the knowledge that it would be possible to build the new towers round the existing headgears, thus causing the minimum loss of production and effecting a swift changeover.

Shallow Shaft Installation

The design of friction winders with two conveyances in balance in a rather shallow shaft has always presented difficult problems because of the need to meet the requiremnts of draft regulations regarding braking and slip conditions. The Dawdon installations were no exception to this. Basically, the effect on the system of the suspended masses governs the relationship between payload and permissible rates of retardation and acceleration. For a given payload the deeper the shaft the greater becomes the weight of the rope so that the suspended masses are increased and the T_1/T_2 ratio (*i.e.*, the ratio of the total suspended masses on one side relative to the total suspended masses on the other) is improved, thus raising the permissible rates of acceleration and retardation.

After discussions with NCB engineers, a design was finalized which satisfactorily met the necessary requirements for friction winders. Fig. 1 shows the two Dawdon towers.

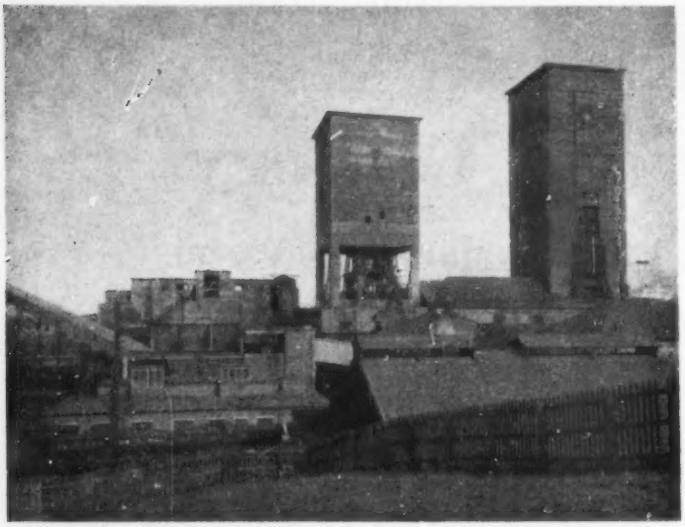


FIG. 1.—TOWER-MOUNTED FRICTION WINDERS AT DAWDON COLLIERY BUILT AROUND THE ORIGINAL HEADGEARS.

Fig. 2 illustrates the arrangement of the winding engine in the tower for the Theresa winder, and Fig. 3 the arrangement of the winding engine in the tower for the Castlereagh winder.

Briefly, the engine has four separate winding ropes connecting the two conveyances and passing over the winding drum, which is mounted in the tower directly above the shaft. A flat balance rope, equivalent to the weight of the four winding ropes connects the two conveyances underneath. Fig. 4 shows schematically a friction winder of this type. The friction material on the drum transmits the drive to the ropes.

For the Theresa winder a set of guide sheaves had to be mounted below the drum so that the ropes could be guided to a position on the conveyances' centre line. The conveyances are positioned in the shaft by guide ropes with fixed guides at the top discharge and bottom loading positions.

The Castlereagh winder conveyances are positioned in the shaft with fixed guides throughout.

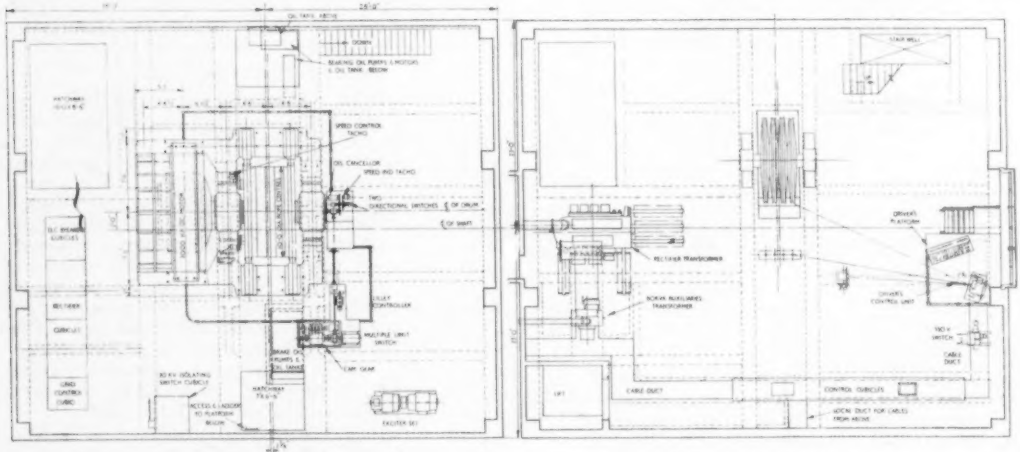
Winding Engine Data

The winding engine data at the time of the design is, for all practical purposes, the same as the final working data and is given in Table 1.

Figs. 5 and 6 show the h.p./time diagrams for the main duty cycles of the Theresa and Castlereagh winders, respectively. Table 2 shows the maximum permissible accelerations and retardations for these winders together with the expected rates of retardation when the brakes are set to meet design and regulation requirements.

MECHANICAL EQUIPMENT

The friction wheel is in halves and of fabricated steel construction with a cast-steel boss. The wheel is secured to the shaft by tangential keys at 120 deg. and the wheel boss is secured with a shrink ring at each side. The rope tread housing has machined



PLAN AT WINDER FLOOR LEVEL PLAN AT DEFLECTOR SHEAVE FLOOR LEVEL

FIG. 2.—ARRANGEMENT OF THE WINDING ENGINE IN THE TOWER FOR THE THERESA WINDER.

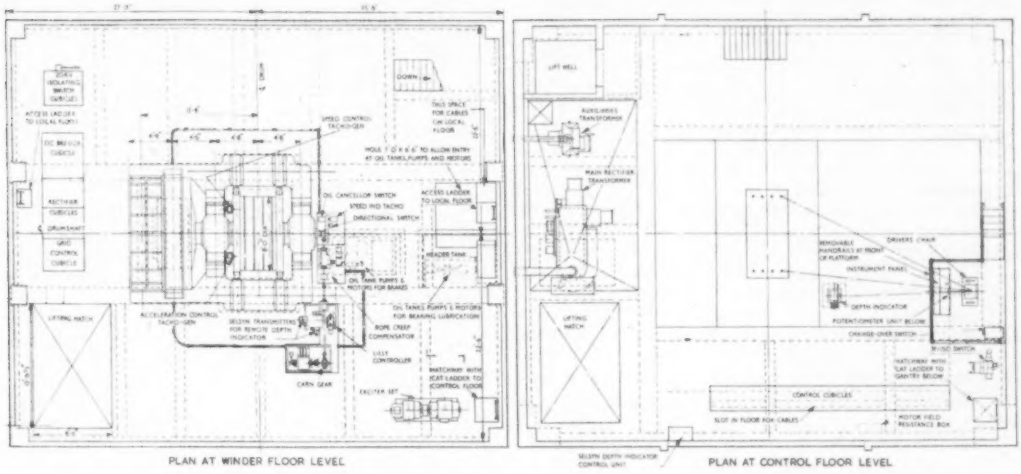


FIG. 3.—ARRANGEMENT OF THE WINDING ENGINE IN THE TOWER FOR THE CASTLEREAGH WINDER.

slots into which the friction blocks are inserted. The locking arrangement for securing these blocks dispenses with a large number of bolts and the sections are easily removed and replaced.

FIG. 4.—SCHEMATIC LAYOUT OF ROPES FOR A FOUR-ROPE FRICTION WINDER.

In order to ensure that no circumferential movement of the insert takes place, special final friction block inserts fitted at the four loading positions on each tread are also held by a spigot on the locking plate bolted to the inside face of the drum.

The frictional wheel shaft bearings, which also support the overhung motor armature, have easily removable cast iron shells, lined with white metal and bedded into cast iron carriages. The design permits the bottom half to be removed from the carriages when they are relieved of the weight of the shaft. The bearings are fitted with oil-ring lubrication, and a continual supply of oil is provided by a gravity system which ensures that each bearing has its reservoir full of oil. The supply of oil from the gravity tank can be regulated. After leaving the bearings the oil enters a drain tank from which it is filtered and pumped back to the overhead tank.

On the motor side of the drum an accurately machined gear is fitted for driving the closed loop speed signal and the acceleration/retardation signal tachometer generators. These drives do not require the application of creep correction and therefore can be separate.

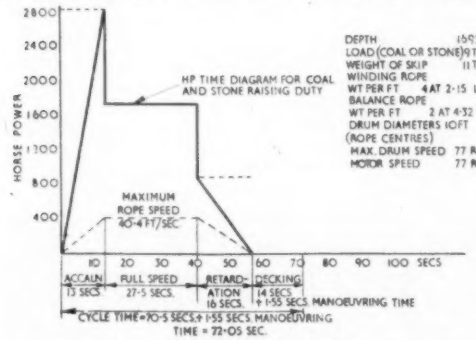

HORSE POWER
2800
2400
2000
1600
1200
800
400
HP TIME DIAGRAM FOR COAL AND STONE RAISING DUTY
MAXIMUM ROPE SPEED 40·4 FT/SEC
DEPTH 1695 FT
LOAD (COAL OR STONE) 9 TONS
WEIGHT OF SKIP 11 TONS
WINDING ROPE WT PER FT 4 AT 2·15 LBS
BALANCE ROPE WT PER FT 2 AT 4·32 LBS
DRUM DIAMETERS 10 FT (ROPE CENTRES)
MAX. DRUM SPEED 77 R.P.M.
MOTOR SPEED 77 R.P.M.
10 20 30 40 50 60 70 80 90 100 SECS
ACCELN 13 SECS
FULL SPEED 27·5 SECS.
RETARDATION 16 SECS.
DECKING 14 SECS + 1·55 SECS. MANOEUVRING TIME
CYCLE TIME = 70·5 SECS + 1·55 SECS. MANOEUVRING TIME = 72·05 SEC.

FIG. 5.—H.P./TIME DIAGRAM FOR THE THERESA WINDER.

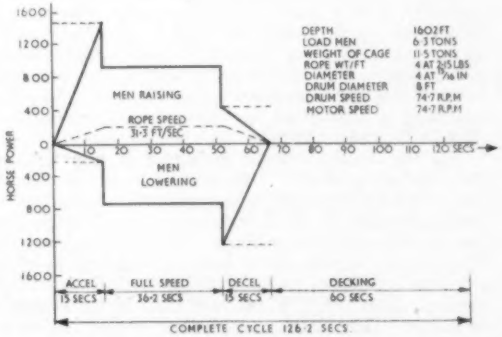


FIG. 6.—H.P./TIME DIAGRAM FOR THE CASTLEREAGH WINDER.

TABLE 1.—*Final Working Data for the Theresa and Castlereagh Winding Engines at Dawdon Colliery.*

	Theresa skip winder.	Castlereagh cage winder.
Type/inclination	Upcast/vertical	Downcast/vertical
Winding depth (ft.)	1,695	1,602
DUTY		
Output	Coal/men, 450 ton/hr.	Men/materials/stone, 225 ton/hr., 950 men/half hr.
CONVEYANCES		
Type	Two skips in balance	Two cages in balance
Weight of each conveyance plus suspension gear (tons)	12.1	11.5
Decks per skip/cage	1	2
Mine cars per cage/total weight (tons)	—	0.66
LOADS		
Coal (tons)	9	—
Stone (tons)	—	6
Men (tons)	1.5 (20 men)	6.3 (84 men)
WINDING CYCLE		
Rope speed (ft./sec.)	40.4	31.3
WINDING ROPES		
Number/size/type	Four/$\frac{11}{16}$-in. dia./LC	Four $\frac{11}{16}$-in. dia./LC
Weight per ft. each rope (lb.)	2.15	2.15
Static factor of safety	7.02 (coal)	7.74 (men) 7.0 (stone)
FRICTION DRUM		
Diameter at rope centres (ft.)	10	8
Rope centres (ft.)	1	1
Angle of lap (deg.)	190	180
FRICTION DRUM		
Tread pressure (lb./sq. in.)	220 (coal)	300 (stone)
Bending factor	127	102.5
Designed coefficient of friction	0.2	0.2
Maximum drum speed (r.p.m.)	77	74.7
GUIDE SHEAVES number/diameter to rope centres (ft.)	Four/9	—
ELECTRICAL SUPPLIES		
H.T.	20,000 V, 3-phase, 50 cycles, neutral earthed system	
H.T. breaking capacity	141 MVA	280 MVA
L.T. colliery supply	500/550 V, 3-phase, 50 cycles, neutral earthed system	
WINDER MOTOR		
Type	Overhung, direct coupled laminated yoke	
Number of motors	1	1
H.P. (R.M.S.)	2,000	1,000
Motor speed (r.p.m.)	77	74.7
Terminal volts (DC)	800	800
RECTIFIER EQUIPMENT		
Number of tanks	4	2
Number of phases	12	12

The creep correction unit is driven by machined gears fitted to the wheel shaft at the end remote from the motor. The drives for the depth indicator, Lilly controller, cam gear, and other auxiliaries are taken from the creep correction unit. The motor driving the creep correction unit is electrically connected so that creep correction automatically takes place when the conveyances are at the extreme normal stopping positions. A hand-operated Vernier coupling is also fitted for manual creep correction should this be necessary.

The mechanical depth indicator is situated on the operating floor. The depth indicator is of the normal vertical type and is fitted with a magnifying dial which indicates approximately the last revolution of the drum. In addition, on the Castlereagh winder there is an alternative driving position at bank and the driver's desk installed there is fitted with a selsyn-driven Vernier depth indicator. The Vernier pointer on this indicator rotates once for every revolution of the drum.

The Theresa winder has four guide sheaves which are of fabricated construction and are situated on the operating floor. One sheave is secured to the shaft and the other three are free to revolve independently of each other. The periphery of each guide sheave has leather friction inserts accurately located and securely fastened in position, the inserts being grooved to suit the rope.

Friction Tread Material

One of the most important features of a friction winder is the material used for the friction drive between the drum and the rope. For this installation it was decided to use friction wheel drive inserts with a cotton base, bonded and moulded under pressure with a synthetic resin.[1] This insert material has very stable characteristics, appears to be almost impervious to temperature changes, is mechanically strong, and is incompressible under the loads it is to withstand. Laboratory tests indicated that the coefficient of friction for this material using a clean dry steel rope was high and tended to improve when the material was wet.

For some time a great deal of thought has been directed towards finding a more suitable material than those already known for friction wheel drive inserts, and this insert appeared to be a step forward. Up to the present, the materials generally used have been elmwood, laminated leather, and woven or moulded asbestos. Looking briefly at the properties of these materials and comparing them with the cotton-base bonded and moulded material the main points of interest are as follow.

Elmwood was probably the most common insert material used in the early days of friction winders, and even today is still very popular. Well-seasoned

TABLE 2.—*Maximum Permissible Accelerations and Decelerations for the Dawdon Winders.*

Maximum permissible accelerations and retardations.	Theresa skip winder.	Castlereagh cage winder.
Acceleration, ft./sec.²		
Raising 9.0 tons, coal	3.37	—
,, 6.0 ,, stone (balanced)	—	5.4
,, 1.5 ,, men	7.45	—
,, 6.3 ,, men	—	4.55
,, 6.0 ,, stone (unbalanced)	—	2.88
Empty conveyances	8.38	9.1
Retardations, ft./sec.²		
Lowering 9.0 tons, coal	4.1 (3.70)	—
,, 6.0 ,, stone (balanced)	—	5.9 (4.44)
,, 1.5 ,, men	8.28 (8.15)	—
,, 6.3 ,, men	—	5.1 (4.7)
,, 6.0 ,, stone (unbalanced)	—	3.42 (3.12)
Empty conveyances	9.2 (9.2)	9.7 (9.05)
Retardations, ft./sec.²		
Raising 9.0 tons, coal	14.1 (12.22)	—
,, 6.0 ,, stone (balanced)	—	13.35 (10.3)
,, 1.5 ,, men	10.2 (9.77)	—
,, 6.3 ,, men	—	14.0 (11.45)
,, 6.0 ,, stone (unbalanced)	—	15.3 (12.35)
Empty conveyances	9.2 (9.2)	9.7 (9.05)

Note 1: Balanced winding denotes the condition when the unloaded cage contains its normal number of empty mine cars. Unbalanced winding denotes the condition when the unloaded cage contains no empty mine cars.

Note 2: The figures in brackets are the expected retardations when the brakes are set to give the following:—

Theresa: 1.465 × cyclic retardation = 3.70 ft./sec.², when lowering 9 tons coal.

Castlereagh: 1.5 × cyclic retardation = 3.12 ft./sec.², when lowering 6 tons stone unbalanced.

elmwood is essential for insert purposes; this is difficult to obtain: even then shrinkage takes place in any direction. Elmwood has a high coefficient of friction under good conditions, but tends to be unstable when first put into service. It also has quite a high wear factor, a feature which on multi-rope friction winders can considerably increase both tread-groove servicing, and rope equalization problems.

Laminated leather placed on end, although quite suitable, has a higher wear factor than the cotton-base bonded and moulded material, and not show such a high coefficient of friction as the latter in laboratory tests. Both woven and moulded asbestos are suitable, but fall into the same category as leather when compared with the cotton bonded and moulded material.

It is reasonable to say that the ideal way of obtaining the correct operational value of the coefficient of friction of a material is to test it on a winder under working conditions, but for a multiplicity of reasons this is more easily said than done. To establish the dynamic coefficient of friction after slip had developed would be an even trickier problem under working conditions.

A laboratory test does not allow for any effect on the coefficient of friction of the friction treads under operational conditions due to:—(*a*) The cleanliness of the rope which may well vary from hour to hour and most certainly from shaft to shaft. (*b*) The deformation of the ropes while torque is being transmitted. (*c*) The change in tensions over the friction wheel. (*d*) The fact that there can be two, three, four, or more ropes. (*e*) The distortion of the rope in the groove due to loading.

At the NCB Central Engineering Establishment, Bretby, it is understood that a more realistic testing equipment than that previously used in laboratories is being devised in an effort to simulate site operational conditions.

High-pressure Mechanical Brakes

Four high-pressure unit brakes are provided, arranged in pairs to operate opposite each other on the two brake paths. The fixed structure is of steel, and designed to be bolted on the winder bedplate. The design and fixing ensures it is entirely rigid.

The concentric and radially moving brake shoe is also of steel construction, and is accurately machined for the brake lining. The shoe is secured to a sliding steel element, designed for very low pressure on the guide faces which are easily renewable. The design of the sliding element, having a small movement on large sliding surfaces with adequate lubrication, ensures a considerable life without adjustment.

The brake linings are suitably mounted so that they can be easily renewed without moving the whole unit. Each unit has compression springs which are designed with a low stress to give all the braking required. These are compressed to the brakes "off" position by a hydraulic cylinder mounted in each unit and released to brakes "on," under control of the driver, or automatically in an emergency.

The hydraulic operating cylinder has no packing or gland, its manufacture being very accurately controlled. The hydraulic components are all of a well-tried design which has given years of service without needing any maintenance. The visual and audible signal for the limit of brake wear is given through built-in limit switches. The positive displacement hydraulic pumps are in duplicate, each one being capable of the full duty, the other acting as a standby. Each pump is of the high speed, horizontal mounting, axial plunger type with motor-mounting gland, motor/pump flexible coupling, and built-in relief valve.

Each unit brake is a complete assembly of brake post and operating gear and is completely independent in its operation having only a common hydraulic supply. The hydraulic pressure is provided from a central point to all the units from the positive displacement pump which incorporates the necessary valves. The use of pins and connecting levers is entirely dispensed with and there are no mechanical connections between the units. With this design, therefore, any one of the four units may be readily isolated if this is required.

The movement to apply the brakes is exactly radial, thus both the clearance and the movement to make contact is truly parallel. By dispensing with a movement through an arc about a fixed pin, or fulcrum, a more accurate contact over the face of the brake is obtained under all conditions of braking, and this is not affected by wear of the lining. This method of brake application is entirely new for hoists and constitutes a complete departure from all the known methods of applying brakes. The brakes are designed to meet all the requirements of failure to safety.

Using high pressure for the system with small movement means that only a very small quantity of fluid has to be supplied or displaced for the operation of the system. The remote control at considerable distance, as used for the bank control on the Castlereagh winder, is most effective and there is no appreciable lag in the operation. A simple adjustment ensures immediate correction for any wear of the brake linings. In addition, there is a ready means for checking the available brake load and the same means can be used should it be necessary to modify this load. The brakes are operated by a pressure-controlled valve. This valve is operated either by a hand lever or in the case of the automatic winder, by a solenoid actuated valve. The brakes are very smooth and rapid in operation.

This completely new design of brake results in a very large reduction in the weight of the moving parts compared with the orthodox pivoted type. The result is that inertia effect of such moving parts is considerably reduced. Fig. 7 shows a typical hydraulic schematic diagram for this type of high-pressure brake engine.

ELECTRICAL EQUIPMENT

The Theresa winder is driven by a 2,000-h.p. d.c. motor and the Castlereagh winder by a 1,000-h.p. d.c. motor. Both of these are self-ventilated,

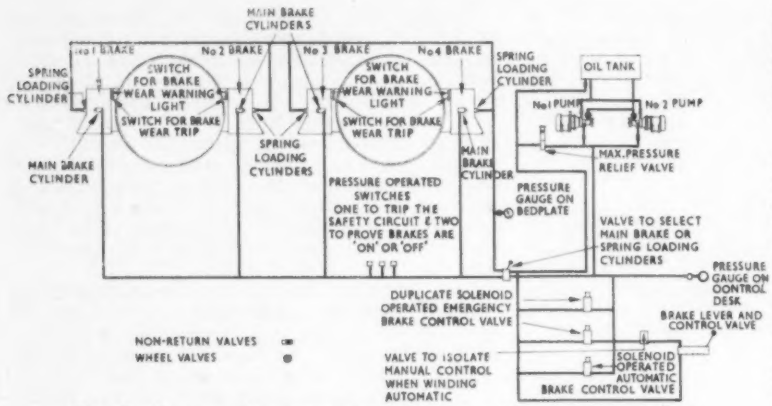

MAIN BRAKE CYLINDERS
No 1 BRAKE
No 2 BRAKE
No 3 BRAKE
No 4 BRAKE
SPRING LOADING CYLINDER
SWITCH FOR BRAKE WEAR WARNING LIGHT
SWITCH FOR BRAKE WEAR TRIP
SPRING LOADING CYLINDERS
MAIN BRAKE CYLINDER
PRESSURE OPERATED SWITCHES ONE TO TRIP THE SAFETY CIRCUIT & TWO TO PROVE BRAKES ARE 'ON' OR 'OFF'
OIL TANK
No 1 PUMP
No 2 PUMP
MAX. PRESSURE RELIEF VALVE
PRESSURE GAUGE ON BEDPLATE
VALVE TO SELECT MAIN BRAKE OR SPRING LOADING CYLINDERS
PRESSURE GAUGE ON CONTROL DESK
DUPLICATE SOLENOID OPERATED EMERGENCY BRAKE CONTROL VALVE
BRAKE LEVER AND CONTROL VALVE
NON-RETURN VALVES
WHEEL VALVES
VALVE TO ISOLATE MANUAL CONTROL WHEN WINDING AUTOMATIC
SOLENOID OPERATED AUTOMATIC BRAKE CONTROL VALVE

FIG. 7.—TYPICAL HYDRAULIC DIAGRAM FOR A HIGH-PRESSURE BRAKE ENGINE.

laminated yoke machines overhung and directly coupled to the respective friction winding drum. These motors are of a type specially developed for tower-mounted multi-rope friction winder drives having an overhung hollow armature coupled directly to the flange integral with the drum shaft forging. Fig. 8 shows this type of armature construction. The commutator is at the end of the winder motor remote from the bearing pedestal and owing to the fact that the d.c. voltage used is 800 V., it is enclosed by a mesh screen fitted with access doors at either side which are electrically interlocked to limit the motor voltage to about 20 per cent. normal when they are opened.

The coupling bolts are fitted from inside the armature, accessibility to the bolts being a feature of the construction. Tightening of these bolts is done by a special hydraulic tool which ensures a safe pre-stressing of all coupling bolts to a calculated limit, equal stressing of all bolts, and ease of erection and, if ever necessary, dismantling.

The motor torque is transferred to the drum shaft from the armature only by the friction between the armature spider and the drum shaft coupling, as the bolts are in clearance holes and there are no driving keys or interference fixed spigots. The electrical supply for these motors is obtained through 12-phase mercury arc converters which are controlled by a fully-closed loop system.

The H.T. supply for the mercury arc convertors is taken from two separate 20-kV., 3-phase, 50-cycle feeders. However, for interchangeability both converters have been designed to operate on either feeder.

Circuit Breakers

Protection for each winder is obtained from a 20-kV. circuit breaker situated in a switchgear substation at the base of the tower. In order to ensure complete safety for people working on the equipment in the tower, especially during maintenance and commissioning times, a 20-kV., air-break, off-load cubicle mounted isolator together with a 20-kV. circuit breaker remote control panel is provided on the winder floor. This 20-kV. isolator has the following features:—

(*a*) An electrical bolt to ensure that isolation or closure cannot be carried out when the 20-kV. circuit breaker is closed. (*b*) Castell keys fitted so that it is impossible to open the cubicle doors when the 20-kV. circuit breaker is closed. (*c*) A changeover switch on the remote control panel operated in conjunction with a changeover switch in the substation to permit closure of the 20-kV. circuit breaker from the local position in the sub-station, and a switch that can be mechanically locked in the open position for completely isolating the supply to the closing coil circuit of the 20-kV. circuit breaker.

In order to permit the remote reclosing of the circuit breaker after trips due to interlocking and auxiliary winder faults (*i.e.*, door interlocks, isolator interlocks, auxiliary circuit-breaker interlocks, laminated exciter field overcurrent, and 20-kV.

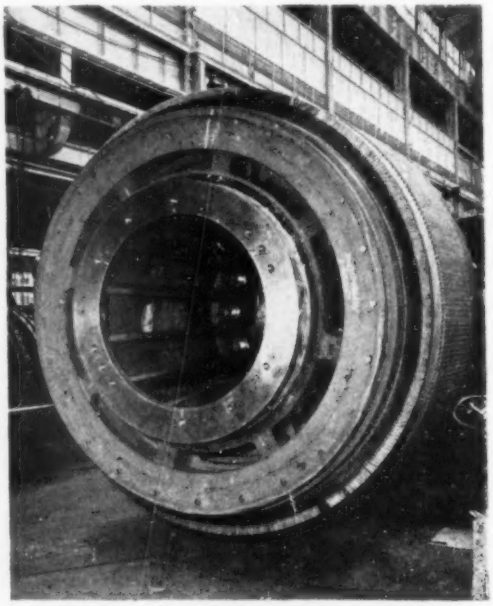


FIG. 8.—CONSTRUCTION OF AN OVERHUNG HOLLOW ARMATURE.

circuit breaker trip pushbutton), a dual shunt tripping circuit has been developed. "Locking out" of the circuit breaker at the sub-station only occurs when the overcurrent, earth fault, undervoltage, or Buchholz protection operate. Lamp indication on the remote control panel in the tower tells the operator whether the circuit breaker is open or closed and if there has been a "lock out" trip.

Two separate 20-kV. cables leave the isolator through isolating links. One of these cables goes to the 3/12-phase rectifier transformer which supplies the rectifier tanks, and the other cable goes to the 3/3-phase 20-kV./220-V. auxiliary transformer which supplies the mercury arc rectifier grid control gear, rectifier auxiliaries, and winder-control circuits.

On the operating floor (which on the Theresa winder also holds four guide sheaves) are situated:—

(1) The rectifier transformers, which because they are in a tower and immediately over the shaft, present a fire hazard, must be filled with a non-inflammable fluid instead of oil, and in this instance Pyrochlor has been used.

(2) The field reversal cubicle.

(3) The servo closed-loop control cubicle.

(4) The control and auxiliaries distribution cubicle.

(5) The driver's chair and instrument panel.

In addition, at the Castlereagh shaft winder is:—

(6) The local/remote changeover switch for changing the control from the tower to the desk at bank position.

(7) The mine hoist recorder.

(8) The Aspinall signal recorder.

On the winder floor are:—

(1) The cubicle-mounted rectifier tanks, four for the Theresa winder and two for the Castlereagh winder, together with the grid control cubicle. These rectifiers give a 12-phase rectified 0/800 -V d.c. supply to the winder motor.

(2) The laminated yoke exciter set for supplying the winder motor field.

(3) The long-range mechanically driven miniature cam gear.

Before[2] proceeding with the aspect of control a brief consideration will be given to the question of inversion (*i.e.*, of passing power from the d.c. side of the rectifier to the a.c. side).[3]

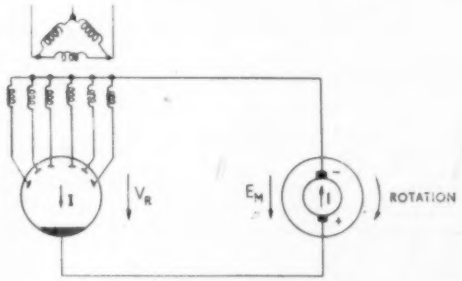
Fig. 9 diagram (*a*) shows the circuit conditions when rectification occurs. For a given direction of rotation of the motor, a back e.m.f. (E_M) is produced which opposes the rectifier average anode voltage V_R and a current I flows through the circuit in the direction shown.

Power is being drawn by the motor from the rectifier and hence, from the supply system. Diagram (*b*) (Fig. 9) shows the anode voltage curves under free-firing conditions. For simplification the effect of transformer reactance has been ignored. The commutation of the arc from one anode to the next occurs naturally as the potential of the second anode rises above that of the first. If it is desired to reduce the output voltage V_R of the rectifier, this commutation of the arc is delayed by means of grid control to a point later in the half cycle.

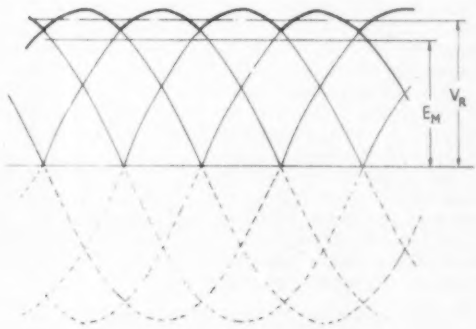
Reversal of Power

It has become the habit to associate the reversal of power with a reversal of current and, at first sight, it would appear that reversal of power is not possible with a mercury arc rectifier in which current can flow in one direction only. However, this is erroneous; for since power is the product of current and voltage, it can be reversed by maintaining the direction of current and reversing the direction of voltage. With the rectifier, therefore, if the establishment of the arc can be arranged to occur when the anode voltage is negative, a reversal of power will be effected, since the current will flow in the same direction while the transformer secondary voltage is of opposite polarity.

In order to achieve this, the commutation of the arc must be delayed by means of grid control beyond the point of zero voltage as shown in Fig. 10 (*b*) to give the rectifier voltage V_R. The current I cannot change its direction, so that the direction of the motor voltage E_M must be reversed as shown in diagram (a) (Fig. 10), the positive role of the motor now being connected to the neutral point of the transformer. The voltage E_M overcomes the instantaneous anode voltage

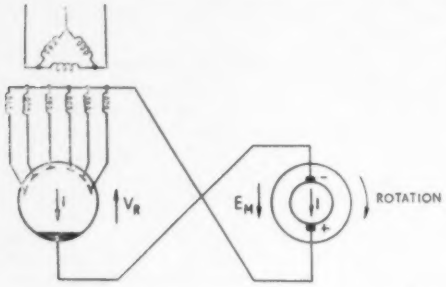


(a) CIRCUIT CONDITIONS

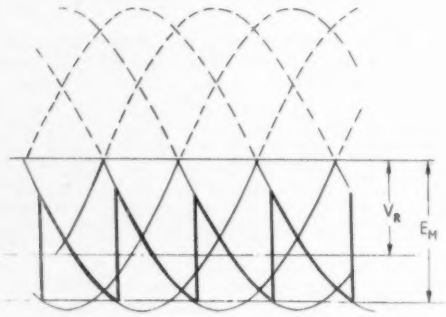


(b) VOLTAGE CURVES WITH FREE-FIRING RECTIFIER

FIG. 9.—DETAILS OF RECTIFIER OPERATION.



(a) CIRCUIT CONDITIONS



(b) VOLTAGE CURVES WHEN INVERTING

FIG. 10.—INVERTER OPERATION.

as well as the arc drop to cause the current I to flow. When the instantaneous anode voltage exceeeds the voltage E_M, the arc is extinguished but the commutation to the next anode can be effected by applying a positive voltage to its grid at this instant.

A point is reached in the cycle of the former anode when its applied voltage again attains the value E_M and, in order to avoid commutation of the arc back to this anode, its grid must be held negative. It will thus be appreciated that inversion cannot be effected without the aid of grid control.

It is also necessary to reverse the direction of the motor voltage E_M and on these winders this is effected by what is termed "Figure O connection with Field Reversal."

The armature connections are maintained and the field of the motor is reversed. This has the advantage that the power involved in the reversing circuit is very much reduced. The magnetic inertia of the field system makes it necessary to force the field and laminate the motor yoke.

CLOSED-LOOP CONTROL

The arrangement of the complete control used at Dawdon Colliery is shown on the simplified schematic diagram in Fig. 11. The number of tanks shown is four, but this is not a factor which affects the description of control because the number of tanks connected in parallel depends on the rating of the winder motor.

In Fig. 11, the rectifier transformer secondary winding is connected to the mercury arc rectifier anodes through anode reactors which are used to ensure that the load is shared equally between the rectifiers. The cathodes of the rectifiers are connected together and form the positive terminal of the convertor. The neutral points of the rectifier transformer secondary windings are connected by interphase transformers to form the negative terminal of the convertor. The motor is connected to these terminals and a d.c. breaker is connected into the cathode lead to protect the d.c. side against short circuits and overload.

The grids of the various mercury-arc rectifiers are connected in parallel to a common phase shifting unit which is controlled in turn by an amplifier operating on the closed-loop system.

The winder motor field is supplied from a split field laminated exciter with rapid response characteristic which in turn is supplied from a separate push-pull control amplifier. The input signal to this amplifier is received from a circuit comprising signals obtained from the motor field current, the direction of rotation and the reverse error relay. The whole is arranged so as to control the motor field current at the appropriate value and in such a direction as to give the required polarity to the motor back e.m.f. The amplifier gives adequate forcing for a speedy reversal.

Speed Control

The output voltage of the mercury arc convertor is controlled by a phase shifting system of the static type. This output voltage is applied to the motor.

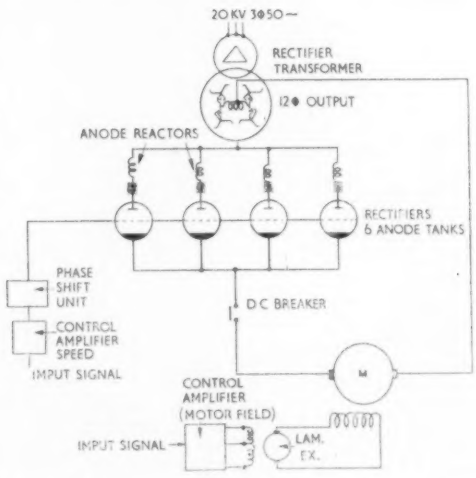


FIG. 11.—SCHEMATIC DIAGRAM SHOWING THE SYSTEM OF CLOSED-LOOP CONTROL USED AT DAWDON COLLIERY.

the speed of which will depend, to some extent, on the load on the motor. The inherent regulation of the system, which is similar to that obtained with the Ward-Leonard system, introduces inaccuracies and, to overcome these, closed-loop speed control is introduced.

With this arrangement a comparison is made between the required speed set by a potentiometer operated by the driver's lever, and the actual speed, determined by a tacho-generator, driven by the winder. The difference between these two voltages, referred to as the "speed error," is used to control the output of the mercury arc rectifier in such a manner as to bring the actual speed as close to the required speed as possible. By using a suitable amplifier the error voltage required to give normal output from the convertor can be made small compared with the reference voltage obtained from the driver's potentiometer. The system, therefore, provides accurate speed control so that a given driver's lever position corresponds to a particular winder speed irrespective of the load on the motor.

Since the error voltage required to produce normal output from the convertor is small compared with the reference voltage, the application of full reference voltage to the system would produce excessive current in the motor circuit. To avoid this, a current limit circuit is introduced. A d.c. signal voltage proportional to current is derived from current transductors in the armature loop and this is compared with a pre-set reference voltage. When the signal exceeds the reference, the output obtained from the amplifier opposes the output of the speed control amplifier so as to limit the current in the armature circuit to some predetermined value. This value is chosen so that the torque imposed on the motor will not exceed the designed limits.

The application of a high torque produces undesirably high acceleration or retardation and, to prevent this, an acceleration and retardation limit is introduced. This limit has a reference circuit similar to that used for the current limit previously described with the signal obtained from an acceleration/retardation tachometer generator giving a rate of change of speed. Acceleration and retardation limits are independent of each other and can have different values.

It was stated earlier that, when changing from rectification to inversion it was necessary to change the polarity of the motor back e.m.f. relative to the rectifier voltage as well as the phase-shift control, so as to function in the negative half-cycle of the anode voltage. Since the driver's lever selects only the direction of rotation and the speeds required, some other means must be employed to make the changes from rectification to inversion and *vice-versa*. The means adopted is a "reverse error relay," the operation of which is as follows.

In the speed control circuit, a comparison is made between the required speed (Vr) and the actual speed (Va) and the difference between these (V error) is used to control the converter output. When Vr is greater than Va and power is required to drive the motor, *i.e.*, for rectification, V error has a particular polarity. However, when Va is greater than Vr so that braking is required on the motor, *i.e.*, for inversion, the polarity of V error is reversed. This reversal of polarity can be detected and arranged to make the necessary changes in the control circuit. Thus the change from rectification to inversion takes place automatically when the actual speed signal exceeds the required speed signal.

Automatic Retardation

Over the retardation distance of the shaft, it is desirable to reduce the speed reference in accordance with the designed winding cycle. The retardation limits set by the control scheme previously described give a greater retardation than the designed cycle retardation and an additional means of producing the normal retardation is provided.

It has been the practice in the past on Ward-Leonard winders where cam gear is used to arrange for the retardation cams to return the driver's lever, and hence the potentiometer, to the neutral position. This requires a fairly elaborate mechanical linkage system between the control lever and the cam gear and also various devices, such as spring or gravity links, cam unlatching mechanisms, etc., to enable manoeuvring and acceleration to be carried out satisfactorily. These disadvantages are overcome on the Dawdon winders by the use of an electrical system in which there is no mechanical connection between the cam gear and the driver's lever.

The cams are so profiled that the designed retardations for men and coal are obtained while the driver's lever is left at the full speed position.

Should the closed-loop system develop a fault which cannot be readily corrected, winding operations can be carried out on an emergency basis. In this case, the operation of a switch cuts out the closed-loop control and introduces a second driver's reference potentiometer which directly controls the grids of the rectifier. This potentiometer is not subject to the overriding control of the cam gear. In addition, the operation of the emergency switch renders the inverter operation of the rectifier ineffective and braking has to be carried out by the mechanical brakes. The absence of current and acceleration limits make it essential for the driver to exercise greater care in carrying out the winding duty under emergency conditions. The protective devices are operative irrespective of whether the winder is under normal or emergency control.

The Theresa winder is designed to run under fully automatic or semi-automatic as well as manual control. Sequence interlocking is included in the automatic control circuit to ensure that the skip loading and discharge motions have been correctly carried out before the next wind can proceed.

PROTECTION

The protective arrangements provided can be divided into two categories, according to whether the immediate purpose is the protection of the rectifier equipment or of the winding engine and d.c. motor.

The system of protection employed for the rectifier equipment embodies a number of protective devices, all of which operate in one of two ways, either:—(1) By preventing the closure of the main circuit breaker when a fault condition exists; or (2) by tripping out the main circuit breaker when a fault condition occurs.

The main 20-kV. circuit breakers on these winders are required to clear a short-circuit fault in less than 0.1 sec. and the protection fitted and directly associated with the winders is:—

(1) A close and trip circuit interlocked to prevent the closure of the circuit breaker under a fault condition, and shunt trip the circuit breaker if any interlocks are opened, but not arranged to cause a "lock out."

(2) Instantaneous peak load overcurrent protection, sustained overcurrent protection, undervoltage protection, Buchholz protection, and sustained earth-fault protection which shunt trip the circuit breaker, causing a "lock out."

The system for the winding engine and d.c. motor comprises the protection of the rectifier transformer secondary winding, and the rectifier and main armature circuit of the d.c. winder motor. The system, which is not earthed, is provided with a single-pole electrically closed, shunt tripped, air break high-speed d.c. breaker fitted with instantaneous overcurrent protection, reverse current protection, and earth-leakage protection which operates through an earth-leakage relay connected in series with an earth leakage indicator.

Temperature protection for the mercury arc rectifier is obtained by a low-temperature lock out which completely locks the winder when the temperature of the rectifiers is too low, high- and low-set thermostats for controlling the fan motors, and a low-set thermostat to switch on the cathode heaters at low temperature.

For the protection of the winding engine and d.c. motor there is:—

(1) A reset contactor to prevent the commencement of winding operations when a dangerous condition exists. Into the coil circuit of this contactor are connected brake interlock contacts, master controller interlock contacts, and on the Theresa winder, automatic/manual interlock contacts, the latter being closed only in the manual position.

(2) A primary safety contactor which in general is used to detect electrical faults, and, when tripped, removes all electrical control from the winder, de-energizing the emergency brake solenoid and thus causing the winder to be brought to rest by the mechanical brakes only. The Lilly controller overspeed contact is in this circuit.

(3) The secondary safety contactor which, in general, is used to detect mechanical faults and which, when tripped, reduces the speed reference voltage to zero and retards the winder electrically by the closed-loop system. Only when a predetermined creep speed is reached is the emergency brake solenoid de-energized and the mechanical brake applied to finally stop the winder.

(4) To protect the insulation of various items of equipment from the voltage surges due to rapid interruption of the arc in the converter, surge arrestors of the Metrosil type are fitted internally in the rectifier transformer and externally across the motor armature.

(5) The d.c. breaker provided for overcurrent protection is set to permit the current equivalent to the peak rating of the d.c. motor in the main circuit. Since the breaker will operate virtually instantaneously, it cannot give any protection against excess temperature resulting from sustained overloads of less than this value. Protection against sustained overloads is obtained on this rectifier equipment from the sustained overcurrent protection on the 20-kV. circuit breakers, as this is a direct reflection of the current flowing in the main d.c. motor circuit.

(6) For other vital pieces of equipment there is either audible or visual alarm, or both, to give indication of failure. Rectifier fan failure, bearings overheating, winder motor overheating, bearing oil flow, warning of pending overspeed, and brake shoe wear are covered by these means.

Each winder is fitted with a full trip indication and closed-loop control monitoring system so that operating personnel have a ready means of determining the fault condition which has been the cause of a particular trip.

SUSPENSION GEAR AND OVERWIND ARRESTORS

Load capsules are incorporated in the suspension gear on one side only, and a direct attachment at the other side. Each set of gear includes a fine adjustment unit, incorporating seven 2½-in. blocks and one 1½-in. block. This gives a total adjustment of 19 in., in 1-in., 1½-in. or 2½-in. steps. Reliance wedge-type cappels are fitted, with white metal rope blocks. Recapping links, 13 in. long, are provided. The load capsules are read daily at shaft bottom, to indicate differences in rope lengths, and at surface, to indicate differences in drum groove diameters.

The overwind arrestors consist of tapered Columbian pine guides in the overwind framework. The overwinding conveyance engages steel shoes which are carried up, or down, the timber guides, one on each side of the conveyance, giving a wedging and retarding effect. The wedges are backed with girders and supported from mild-steel buntons. Should the conveyance not be slowed down, it will finally meet the fixed bumping beams, in the towers and shaft bottoms. The wedges are arranged so that the descending conveyance engages before the ascending conveyance, tending to induce rope slip on the winder drum.

ERECTION

Fig. 12 shows sections through each tower and the relative position of the old headgear. On the Theresa winder both the guide-sheave floor and the winder floor were above the existing steam winder headgear. This is the upcast shaft, and the whole tower has been designed to be in the

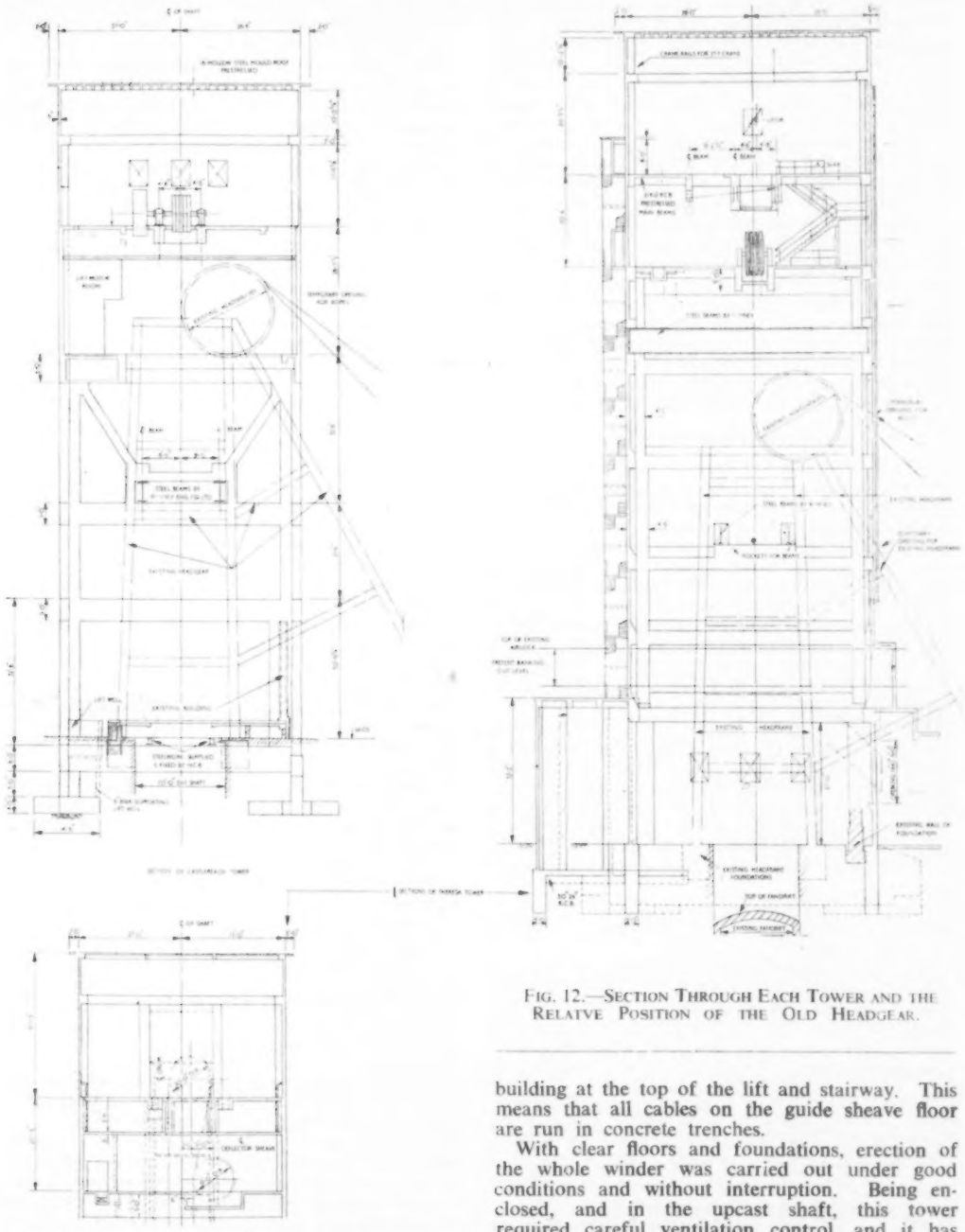


FIG. 12.—SECTION THROUGH EACH TOWER AND THE RELATIVE POSITION OF THE OLD HEADGEAR.

airlock. It is possible, if desired, to remove the winder and guide sheave floors from the airlock, because airlock doors have been included in the building at the top of the lift and stairway. This means that all cables on the guide sheave floor are run in concrete trenches.

With clear floors and foundations, erection of the whole winder was carried out under good conditions and without interruption. Being enclosed, and in the upcast shaft, this tower required careful ventilation control, and it has always been pleasantly warm.

On the Castlereagh winder the winder floor was clear to work on, but the steam winder headgear

sheaves protruded through the operating floor. On the operating floor stand the control cubicles, rectifier and auxiliary transformers and the driver's chair and instrument panel. This operational steam winder made the erection of Castlereagh in consequence a far more tedious and difficult job than Theresa.

The driver's platform, chair, and instrument panel were mounted immediately under one of the steam winder ropes, and a considerable number of cables had to be run under the operating floor.

Castlereagh is the downcast shaft and the tower is of open design at the bottom with the result that, prior to the changeover, it was cold and the operating floor often wet and windy. It spite of all this it was possible to position all the equipment at the design stage so that only one section of the driver's platform and instrument panel had to be moved a few feet some weeks after commissioning. Even now that the operating floor is completed it is still cold inside Castlereagh tower.

COMMISSIONING

It is possible on this type of equipment to carry out a considerable amount of commissioning work prior to rope installation by running with a light drum, if the conditions permit. On both these winders it was possible to take full advantage of this initial period to phase out the rectifiers; test and adjust all the protection; set the closed-loop speed control; set the current, acceleration, and retardation limit features; set the field reversal and inversion control; set the emergency control; test and try out the circuits; run the drum, and check all drives and bearings; and provisionally set up the mechanical brakes.

Castlereagh again proved more tedious than Theresa owing to the previously mentioned abnormal working conditions. One of the most awkward problems was the essential access to the driver's chair and platform. It was not possible to sit upright in the chair due to the presence of the steam winder rope while high noise level made communication with the winder floor extremely difficult.

The " no load " testing and setting up were completed well before the time for rope installation on both winders.

The four winding rope reels were mounted at the man-riding hallway underground at the Theresa Shaft. The north skip was on the girders near this level, the south skip on the changing platform at surface. The shaft servicing jack engine hauled all four ropes together up the shaft, with two clamps 200 ft. apart, on guide rope riders. The top rider was disconnected at the surface and the rope ends passed over the winder drum down to the skip and attached. At shaft bottom, each rope in turn was tensioned to 2¼ tons, cut to length, and socketed. The north skip support girders were removed and the four ropes attached.

The balance rope was installed by attaching the rope end to the north skip, the reel being in the shaft-bottom hallway. The skip was wound to the surface, pulling with it the balance rope which was then cut to length and fastened to the south skip now in the shaft bottom. The time taken for this installation was 60 hr.

The method of rope installation for the Castlereagh Shaft was largely as for Theresa, except that the balance rope and new cages had been installed previously, leaving the winding ropes to be installed. The time taken was 24 hr.

After rope installation it was, of course, necessary to check all the limit settings and the stability of the closed-loop control. In conjunction with this, all the normal settings, tests and checks had to be made, *i.e.*, Lilly controller tests, shaft limit switch adjustment and mechanical brake settings. The winders were then put into service.

The operational results obtained with the control schemes on these installations are an improvement on those obtained on earlier installations because of the improved techniques used. The phenomen of overshoot when lowering the load during the changeover from rectification to inversion is also present on these installations. On the Castlereagh winder the overshoot is appreciable because of the high natural acceleration of the system. This necessitated reducing the maximum speed of the winder as a temporary measure until modifications to the control scheme could be effected. These modifications have now been tested and results have shown that the overshoot can be reduced to a value which will permit the designed full speed to be attained.

During the commissioning of both winders and on one occasion after the Castlereagh winder was put into service, slip between the ropes and the friction tread was experienced. It is considered that, on these occasions, the major contributing cause of the slip was the presence of excessive rope lubricant which lowered the co-efficient of friction between the rope and the tread to below the designed value of 0.2. Excess lubricant (petroleum jelly) is generally exuded from a new rope during its early life to a greater or lesser degree, and it was removed on these winders by cleaning the ropes with scouring materials. Excess lubricant is no longer exuded from the ropes and satisfactory operation is being obtained. It may in fact be necessary to apply a limited and controlled amount of rope lubricant externally to the ropes so as to prevent corrosion of the wires. It should be noted that slip has occurred on other friction winder installations in similar circumstances. The degree of slip on the Theresa winder was, on one occasion, slightly greater than had previously been experienced. It was noted that the rope speed initially decreased, but then the conveyances continued to move in the shaft at a steady speed of approximately 15 ft./sec. until they were arrested by the retarders. Nothing was felt in the tower when this occurred and it is very commendable to the retarder designers that the conveyances were brought to rest satisfactorily. After the replacement of the retarding timbers, the equipment was soon ready for use.

This incident indicates that the relative movement between the rope and the tread material did not

produce the required conditions to restore the coefficient of friction to its normal value. This is probably due to the fact that the tread material is extremely hard and no "self-scavenging" takes place—"self-scavenging" being the action of cleaning the tread during slip by tearing away the surface material. Against this must be weighed the advantage of the hard material in reducing wear and hence prolonging life. As a result of these experiences, it has been decided to replace the friction tread material on the Castlereagh drum. Iroko timber, which has been used on other installations in the division, is to be used as it is thermally more stable than elmwood and, although hard, it should have the characteristic of being "self-scavenging" under slip conditions. At the same time the suspended masses are being increased by using larger ropes (four at $1\frac{1}{16}$ in. dia.) and heavier conveyances so as to improve the $T_1:T_2$ ratio. This will result in an increase in the permissible retardations as shown in Table 3. It should be noted that these retardations are those at which slip would occur if μ were 0.2. In fact, the coefficient of friction is normally appreciably higher than this and an adequate margin of safety is thus provided.

TABLE 3.—*Projected Results of Modifications to the Castlereagh Cage Winder.*

Maximum permissible accelerations and retardations.	Castlereagh cage winder.	
	Original calculations.	Modified winder calculations.
Accelerations, ft./sec.²		
Raising 6.0 tons, stone (balanced)	5.4	6.1
,, 6.3 ,, men	4.55	5.47
,, 6.0 ,, stone (unbalanced)	2.88	4.23
Empty conveyances	9.1	9.23
Retardations, ft./sec.²		
Lowering 6.0 tons, stone (balanced)	5.9 (4.44)	6.5 (4.18)
,, 6.3 ,, men	5.1 (4.7)	5.97 (4.36)
,, 6.0 ,, stone (unbalanced)	3.42 (3.12)	4.69 (3.12)
Empty conveyances	9.7 (9.05)	9.82 (8.06)
Retardations, ft./sec.²		
Raising 6.0 tons, stone (balanced)	13.35 (10.3)	12.94 (9.45)
,, 6.3 ,, men	14.0 (11.45)	13.33 (10.28)
,, 6.0 ,, stone (unbalanced)	15.3 (12.35)	14.41 (11.0)
Empty conveyances	9.7 (9.05)	9.82 (8.06)

Note 1: Balanced winding denotes the condition when the unloaded cage contains its normal number of empty mine cars. Unbalanced winding denotes the condition when the unloaded cage contains no empty mine cars.

Note 2: The figures in brackets are the expected retardations when the brakes are set to retard 6.0 tons stone unbalanced lowering at:—1.5 × cyclic retardation = 3.12 ft./sec.².

CONCLUSIONS

Conveyance and counterweight equipments were considered at Dawdon, but rejected because of the extensive modifications that would have been necessary in the shaft furnishings. On future installations similar to Dawdon, where shaft conditions permit, the use of a conveyance and counterweight equipment would increase the margin between actual cyclic retardations and the permissible retardation based on slip calculation.

The friction tread material used at Dawdon, having a longer life, maintains the tread concentricity for greater periods than many other materials. This factor assumes greater importance on deeper shafts and harder worked shafts; however, because of this hardness and reduced wear, there is no "self-scavenging" effect, which for some duties could be unsatisfactory. It may well arise that certain types of friction material are more suitable for certain winder duties than others.

This performance clearly vindicates the decision taken by the NCB to install friction winders in these shafts.

The author wishes to express his appreciation to No. 2 Area, Durham Division of the National Coal Board, and the NCB headquarters for their assistance, to A.E.I. Heavy Plant Division for permission to publish the paper, to Robey & Company, Limited, Lincoln, and to his colleagues for their help in its preparation.

REFERENCES

[1] Crompton, A. (Robey & Company, Limited), "Rope Treads for Multi-Rope Friction Winders."
[2] Abram, L., "Application of Mercury Arc Rectifiers to Mine Winders," reprinted in the Mining Mechanical Engineer, June, 1959.
[3] Rissik, H., Cit. chapter XI.

STEMMING FOR COAL MINE EXPLOSIVES

EITHER common salt or water may be superior to ordinary fireclay for stemming coal mine explosives, the Bureau of Mines, US Department of the Interior, reports following extensive laboratory studies. New findings regarding relative safety of various stemming materials resulted from investigations at the bureau's Explosives Research Laboratory in Pittsburgh, Pa. The bureau's findings and an explanation of the tests are covered in Report of Investigations 5863, "Relative Efficacy of Stemming Materials in Reducing Incendivity of Permissible Explosives," by R. W. Van Dolah, N. E. Hanna, and R. L. Grant. Copies can be obtained from the Publications-Distribution Section, Bureau of Mines, 4,800, Forbes Avenue, Pittsburgh 13, Pa.

Stemming is designed to contain the force of an explosion and make it more effective in breaking up coal or rock. However, stemming also should reduce the "incendivity" of the explosive by cooling or otherwise controlling the resulting hot gases. This minimizes the chances of igniting coal dust or gas. Stemming materials tested by the bureau, according to the report, were wet and dry fireclay, both tamped; plain water, gelled water, and a concentrated salt solution, all in plastic bags; ordinary granulated salt, of differing meshes, in asbestos cups; and a commercial stemming device. They were tested for incendivity in a flammable gas-air atmosphere with eight separate "permissible" explosives.

OZALID COMPANY, LIMITED, Langston Road, Loughton (Essex)—"Oza-Kling is the toughest, most versatile, and easily applied self-adhesive film available," states a pamphlet, which goes on to explain in some detail what it is and what it does.

COMPRESSOR PROTECTIVE EQUIPMENT

DEVELOPED in collaboration with the National Coal Board, Teddington Industrial Equipment, Limited, Sunbury-on-Thames (Middx), has produced a new range of compressor protective equipment, the "Series 200," which supersedes the "Series 3,000." The equipment complies with all the relevant clauses in the NCB Codes and Rules. It is capable of providing, without modification, automatic protection against a combination of different hazards and is designed to be serviced, by replacement, both simply and quickly.

The "Series 200" gives both visual and audible warning when a fault condition develops, and it automatically operates to shut down the compressor. When the fault has been rectified, it is only possible to reset the equipment by using a special key, which should be left in the care of an authorized person. In the unlikely event of a fault occurring within the equipment itself, the protective devices fail to safety and, once again, the compressor will be shut down.

The equipment consists of the Teddington intrinsically safe indicator unit together with a flame-proof control and interlock unit. The latter has been developed by John Davis & Sons (Derby), Limited, in conjunction with Teddington Industrial Equipment and the NCB. The equipment also comprises an alarm bell, which is shown in Fig. 1, together with the ancillary protective devices, *viz.*, the oil level switch and the water flow indicator. The visual indicators and their associated circuitry are housed in the indicator unit and the protective devices are mounted externally on its underside. The control and interlock unit contains the relays that operate to shut down the compressor and energize the alarm bell. It also contains a delay circuit which overrides the pressure switches while the compressor is running up to speed.

The protective devices, because they are mounted externally, may be removed *in situ* without disturbing the rest of the equipment. The plugs on the indicator unit, with which the protective devices mate, are interchangeable, in as much as every plug can accommodate any one of the four types of protective device. Indicator units equipped to take 4, 6, 8, or even 20 devices are being produced and since there are four different types: thermostats, pressure switches, level switches, and flow indicators, each capable of measuring a different parameter, the number of different combinations is extremely high. Furthermore, it is not essential to utilize every plug position, for bridge plugs are provided to complete the circuit when a protective device is not required.

As a result, the "Series 200" is extremely versatile and, although it was originally created for the protection of air-compressor plant, it has great scope and could be used to advantage in many other applications.

The equipment can be serviced by replacement and both the indicator unit and the control and interlock unit may be opened below ground for inspection purposes. The front cover of the control and interlock unit can only be removed when the mains isolator switch is off.

Customers have been advised not to attempt to adjust the protective devices, but the company has produced a test rig which can be used in colliery workshops to check the accuracy of the set points. The thermostats have an accuracy of ± 40 deg. F. and are unaffected by the depth of installation or the barometric pressure. The pressure switches are accurate to within ± 1.5 lb./sq. in. On a recent test carried out at Teddington a pressure switch completed 3,257,336 successful operations without any signs of deterioration.

FIG. 1.—EQUIPMENT COMPRISING THE "SERIES 200" RANGE OF COMPRESSOR PROTECTIVE EQUIPMENT. TOP:—LEFT: INTRINSICALLY SAFE INDICATOR UNIT (WITH THERMOSTATS AND PRESSURE SWITCHES); CENTRE: OIL LEVEL SWITCH; RIGHT: FLAMEPROOF CONTROL AND INTERLOCK UNIT. BOTTOM:—LEFT: ALARM BELL; RIGHT: WATER FLOW INDICATOR.

ARMCO CHILE, a company recently formed by the US Armco International Corporation and Compañia Electro Metalúrgica, has opened a works near Concepción which will use steel from the Huachipato mill to produce steel balls for milling or crushing ores. It will supply the needs of the copper-mining companies.

SOLIDIFICATION of *Ingot Feeder Heads*

COMMENT ON PAPER AND AUTHORS' REPLY

Comment by N. Chvorinov on the paper by Lubomir Smrha and Ivo Brodsky, members of the research staff at the Klement Gottwald Iron and Steel Works, Vitkovice, Ostrava, together with the authors' reply, is given below. The paper, translated from Hutnické Listy, was published in our issue of December 22, p. 1345.

THE article by L. Smrha and I. Brodsky on "Influencing the Solidification of Ingot Feeder Heads" merits serious attention, since it relates to a problem which is important not only from the metallurgical aspect, but also from the point of view of national economy. A considerable number of scientific papers have been published on increasing output by means of a reduction in top discard. Increased attention has also been devoted to the problem of ingot feeder heads in recent years in the USSR, as may be seen from the conference at TsNIIChM at the end of 1958.[1]

The article must be assessed simultaneously from two aspects at least: that of the real effect in reducing the weights of ingot feeder heads by means of the exothermic inserts (rammed linings) and the exothermic powder used by the authors, and from the aspect of the real savings gained by methods used.

One of the causes of numerous false conclusions is ignorance of comparative standards. The size of ingot feeder heads is considerably dependent on many factors, such as the shape of the ingot, the shape of the feeder head, the composition of the steel, etc. Thus, for instance, a shrinkage cavity extending to the full depth of the feeder head is formed on an ingot with a ratio H:D = 1.5 with steel containing 0.75 per cent. C, well deoxidized with aluminium, even at a feeder head weight of 20 per cent. of the ingot. On ingots with a ratio H:D = 4.5 with carbon steel containing 0.35 per cent. C, not deoxidized with either Al or Ti, feeder heads weighing 7 per cent. of the weight of the ingot may be sufficient to prevent the shrinkage cavity reaching into the body of the ingot.

For any comparison of the saving in the weight of ingot feeder heads it is therefore necessary completely to take into account the shape of the ingot and the composition of the steel. Neglect of these basic criteria has hitherto led to many incorrect conclusions. The decisive factor is not the weight of the feeder head, but the top discard during mechanical working, in addition it is necessary to know that this does not completely correspond with the weight of the feeder head, since it is dependent on what is the reserve in height of the material of the feeder head and on a number of conditions during mechanical working and dressing of the ingots. As an illustration, at the Konev Works, on ingots with an average weight of the feeder head of 13 per cent. of the ingot, the top discard is also about 13 per cent., whereas at the Poldina Works ingots with an average weight of the feeder head of 11 per cent. produce an average top discard of 14.5 per cent. At the Konev Works the ingots are heated in soaking pits and are heated through symmetrically, whereas at the works in Poldina during heating in pusher-type furnaces the heating is not symmetrical, which leads to unsymmetrical mechanical working and elongation, and then demands a considerable discard from the body of the ingot.

In so far as during the testing of experimental or production ingots it is normally impossible to obtain ingots with the same reserve in height of the material under the shrinkage cavity—which alone can then be compared quantitatively—it is necessary to make an accurate conversion of the reserve in height to comparable values. In Fig. 37 is shown the relationship which was established by us between the change in weight of an ingot feeder head and the ratio ε:D, a measure of the reserve in height below the shrinkage cavity. The relationship is valid for ingots of any given shape and any shape of the feeder heads, as well as ingot size. Within the "zone" of the shrinkage cavity it is essential to include both segregation and the zone of material of diminished value below the shrinkage cavity, where this area exceeds the normal extent.

For the VI A ingots tested by L. Smrha and I. Brodsky, with a ratio of the height to the width under the feeder head H:D = 2.75 and with the normal shape of the feeder heads and type of hot-top, the critical value amounts to 10.5 per cent. for carbon steels with a C content of 0.15 to 0.40 per cent. The weight of the feeder head to obtain the minimum top discard during rolling must be at least 1 per cent. greater than that of the feeder

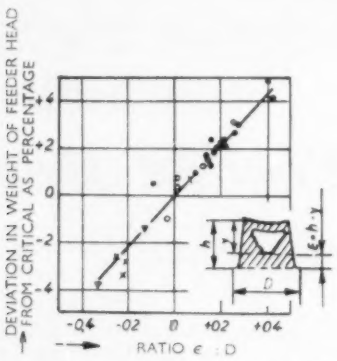


FIG. 37.—RELATIONSHIP BETWEEN THE RATIO ε : D, A MEASURE OF THE RESERVE IN HEIGHT BELOW THE SHRINKAGE CAVITY AND THE VARIATION IN WEIGHT OF THE FEEDER HEAD FROM THE CRITICAL VALUE.

CODE: ● 0.9-ton ingot, H : D = 4, hot-top with reverse taper.
▽ 50-kg model ingot H : D = 1.37.
○ 50-kg model ingot H : D = 3.05.
× 50-kg model ingot H : D = 2.07.

head of critical size shown in Fig. 37. With accurate maintenance of the dimensions of the feeder heads the most suitable reserve under production conditions is 1.5 per cent., *i.e.*, the average production weight of the feeder heads of VI A ingots amounts to 12 per cent. for carbon steels containing 0.15 to 0.40 per cent. C. For AKVS and AKVE extra S steels it is necessary to increase the production weight by about 2 per cent. This is valid also for a number of low- and medium-alloy steels, for instance, MnSi steels with a content of under 0.4 per cent. C. For steel with a higher carbon content, 0.75 per cent. C for instance, a feeder head with a weight of 16 per cent. is required.

Let us devote our attention first of all to Table 2, in which a comparison is made of the savings obtained by heating with various exothermic mixtures. As has already been shown, the comparable production figure for the size of a feeder head for a VI A ingot is 12 per cent. for carbon steels with up to 0.4 per cent. C. The minimum size of feeder head stated by the authors of 9.6 per cent. is within the range of variations for the critical feeder head, and can be correct in individual instances of testing, but in no instance is it sufficient as a production figure to obtain the minimum top discard.

The weight of the feeder head according to the results of heating with Thermit in the Imatra Steelworks in Finland[2] of 5.3 per cent. may be considered as correct. It may be assumed that the 3-ton ingots teemed in this steelworks will have a normal shape ratio H : D = 2.6 to 2.9, and a production size with normal handling of 12 per cent. In this event the reduction in weight resulting from heating with Thermit is 6.7 per cent. The effect of heating with Thermit would here correspond to a decrease in weight of 2.7 per cent. per 1 kg. Al added to an ingot ton. According to our tests on ingots of production size and on model ingots the average effect of Thermit corresponds to 2.5 to 3.0 per cent. per 1 kg. Al per ingot ton, *i.e.*, corresponds to the value obtained with the technique at the Imatra Steelworks.

We can set aside the data presented in Table 2 of the paper for the effect of "exothermic heating without Thermit." In the text of the article it is stated that "in all instances solidification of the feeder heads was influenced by means of an exothermic, rammed lining and with an exothermic powder containing aluminium." In Table 2 the quantity of powder is shown as 3 kg./ton and its price as 13.90 Kcs., so that it cannot apply to an exothermic rammed lining with an exothermic powder, for which values of 9.1 kg./ton for the rammed lining and 1.87 kg./ton for the exothermic powder with a total specific consumption of aluminium of 2.7 kg./ton are shown in the conclusions. Based only by the price of aluminium, this is about 40 per cent. higher than the price shown in Table 2. On the other hand, the weight of the feeder head is stated to be 5.3 per cent., which corresponds on a comparable ingot to a reduction in weight of 6.7 per cent.

For "exothermic powder containing ferroalloys" the figure for the feeder head is stated to be 8 per cent. and the corresponding saving 1.61 per cent. Indeed, in a paper[3] S. Kubena has stated values of the saving for ingots starting from VI A up to 11 tons of 5 to 8 per cent.

The difference between 5 to 8 per cent. and the value of 1.6 per cent. in Table 2 is somewhat large, larger than the saving obtained by effective methods of heating. And Smrha and Brodsky state that "according to experience under production conditions at the Vitkovice Steelworks on larger ingots from 3.8 to 11 tons in the best instance the same results were obtained as at the 'Hammer and Sickle' Works."

Even in this instance we see a certain confusion and lack of clarity of the comparable criteria. In the interests of economy one might insist on the conduct of heating with exothermic mixtures in accordance with the "progressive methods of the Vitkovice Steelworks." What saving is afforded by the use of exothermic mixtures in the old Vitkovice Steelworks? Is this 1.6 per cent. or 5 to 8 per cent.?

At the "Hammer and Sickle" Works through the use of an exothermic mixture of nitrate and FeSi originally *a decrease in the top discard in the blooming mill of* 2.3 *per cent.* was obtained, and this was from an original value of about 14 per cent.

Later, with a simultaneous change in the shape of the feeder head, an increase in yield of more than 3 per cent. was obtained,[1] and a figure for the top discard of 10.5 per cent. was reached. This mixture was also tried out in other steelworks, and in various instances savings of 1 to 3 per cent. were obtained. In certain instances the results were negative.

At the United Steelworks, at both works use is made of exothermic mixtures of the types stated in the paper published by the research workers at the "Hammer and Sickle" Works. In the mean-

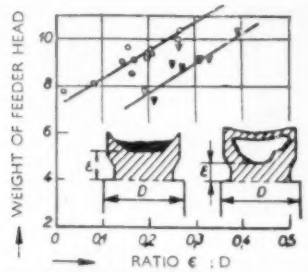


FIG. 38.—COMPARISON OF THE WEIGHT OF THE FEEDER HEAD AND THE RESERVE IN HEIGHT BELOW THE SHRINKAGE CAVITY ON NORMALLY TREATED FEEDER HEADS AND THOSE TREATED WITH POWDERED, EXOTHERMIC MIXTURE.

CODE: ○ Sprinkling with powdered fireclay or graphite.
▼ Sprinkling with a mixture of 1.5 kg/ton of 20 per cent. nitrate + 70 per cent. FeSi (75 per cent.) + 10 per cent. CaSi.
Sprinkling with a mixture of 1.5 kg/ton of 20 per cent. nitrate + 72 per cent. FeSi (45 per cent.) + 8 per cent. CaSi.
▽ Sprinkling with a mixture of 1.5 kg/ton of 33 per per cent. nitrate + 22 per cent. FeSi (75 per cent.) + 3 per cent. CaSi + 42 per cent. graphite.

time, savings under production conditions have not been assessed accurately with success. The results of tests carried out by us on sections through feeder heads at the works in Poldina are shown in Fig. 38, which plots the weights of feeder heads in relation to the reserve height of the material under the shrinkage cavity or under the zone of material of inferior quality. From the results it is evident that the effect of exothermic mixtures containing sodium nitrate and FeSi on ingots with a ratio H : D = 4 varies from 1 to 2.5 per cent., according to the type of feeder head and dependent on how we assess the reserve.

In Figs. 39, 40, 41, and 42 are compared macro-etchings of the feeder heads of four ingots poured on a group teeming stool. Their treatment was in the same order; sprinkling with fireclay powder, sprinkling with charcoal, sprinkling with an exothermic mixture of sodium nitrate +FeSi +CaSi, and sprinkling with an exothermic mixture of sodium nitrate +FeSi +CaSi in a proportion corresponding to a reaction without an excess of Si by means of a moderated addition of graphite. Fig. 40 shows the deterioration in the material in the feeder head through the excess of Si and also through increased segregation. If we compare Fig. 40 with Fig. 39, we see that, if we assess the segregation as material of diminished value, then the effect of this exothermic mixture is very small. By this assessment Fig. 42 shows a greater effect of the powder. Fig. 43 shows a macro-etching through a risen feeder head (single hot-top of CT mixture) treated with an exothermic mixture; we see the same picture of deterioration of a considerable layer of material through silicon from an excess of FeSi and increased segregation beneath this layer. In Fig. 44 is a sulphur print of the same section, in which the segregation is more readily visible.

In Fig. 45 for comparison is a further sulphur print of a section through a feeder head of the type and of the same shape of ingot treated with a sodium nitrate mixture with a higher proportion of FeSi, where the deterioration of the material through silicon and the segregation are even more marked. For comparison, in Fig. 46 is the sulphur print of a section through a feeder head of the same type after treatment with fireclay powder.

Where the size of the top is inadequate, debased material may pass into the axial zone of the body of the ingot when an exothermic mixture of the type indicated is used. *The saving in material through the use of an exothermic mixture on the basis of sodium nitrate +FeSi in an unbalanced proportion depends on what deterioration we permit. The use of these mixtures demands an accurate technique,* i.e., *the maintenance of the accurate, required size of the feeder heads according to the grade of steel, otherwise it may prove detrimental through uncontrolled deterioration of the quality of the steel in the axial part of the ingot under the feeder head.* According to our experiments, if we are not to impair the quality of the material in the body of the ingot under the feeder head, by means of an exothermic mixture as used at the "Hammer and Sickle" Works with a

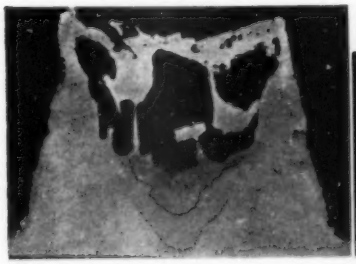


FIG. 39.—MACRO-ETCHING OF A SECTION THROUGH A FEEDER HEAD SPRINKLED WITH FIRECLAY INGOT WEIGHT 0.9 TON; H : D = 4.1).

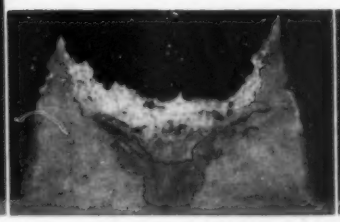


FIG. 40.—MACRO-ETCHING OF A SECTION THROUGH A FEEDER HEAD SPRINKLED WITH AN EXOTHERMIC MIXTURE OF 20 PER CENT. NITRATE + 72 PER CENT. FeSi (45 PER CENT.) + 8 PER CENT. CaSi.

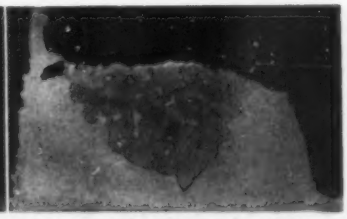


FIG. 41.—MACRO-ETCHING OF A SECTION THROUGH AN INGOT SPRINKLED WITH CHARCOAL.

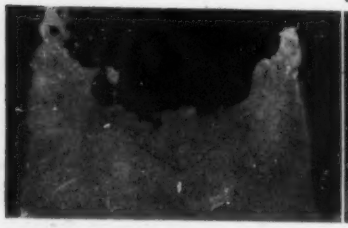


FIG. 42.—MACRO-ETCHING OF A SECTION THROUGH A FEEDER HEAD SPRINKLED WITH AN EXOTHERMIC MIXTURE OF 30 PER CENT. NITRATE + 20 PER CENT. FeSi (75 PER CENT.) + 3 PER CENT. CaSi + 45 PER CENT. GRAPHITE.

FIG. 43.—MACRO-ETCHING OF A SECTION THROUGH A FEEDER HEAD WITH A REVERSE TAPER (SINGLE HOT-TOP OF CT SAND). INGOT WEIGHT, 0.9 TON, H:D = 4.0. FEEDER HEAD SPRINKLED WITH EXOTHERMIC MIXTURE OF 20 PER CENT. NITRATE + 70 PER CENT. FeSi (75 PER CENT.) + 10 PER CENT. CaSi.

normal addition of from 1 to 1.5 kg./ton it is possible to obtain a reduction in the weight of the feeder head of only 1.5 to 2 per cent. on ingots with a ratio H:D = 4; 2 to 2.5 per cent. on ingots with a ratio H:D = 3; and 2.5 to 3 per cent. on ingots with a ratio H:D = 2.5.

For the mixtures used at the old steelworks in Vitkovice, on the basis of theoretical calculation, we reckoned the probable lowering in the weight of the feeder head would be 3 to 4 per cent. The higher figures for this reduction in weight stated by S. Kubena were obtained as a result of the original large reserve of the feeder heads (for instance a feeder head weight of 18 per cent. of the ingot).

The value of 1.6 per cent. given by the authors in Table 2, therefore, has been calculated at a somewhat low figure for these exothermic mixtures and the given type of ingot.

To determine the effect of the exothermic, rammed lining used by Smrha and Brodsky we checked the data presented in the paper. After conversion, for the use of an exothermic, rammed lining with an exothermic powder "not containing Thermit" the results on average give a critical weight of the feeder heads corresponding to 3.9 per cent., and therefore to a production figure of 5.4 per cent., which agrees with the suggestion of the authors. On this basis the saving on the feeder head with the same reserve as on a 12 per cent. feeder head without the use of heating would amount to 6.6 per cent., *i.e.*, the same as with heating by means of Thermit used at the Imatra Steelworks (see Table 3).

The analysis carried out permits us to compile a provisional comparison of the effect of the various methods of heating by means of exothermic mixtures shown in Table 3. From the review it is apparent that the specific raw material costs for 1 per cent. of material saved per ingot ton are greatest for the exothermic, rammed lining with an exothermic powder on top. The costs for heating with Thermit are lower.

But the total costs are made up not only of the costs for raw materials, but also include labour for preparing the mixture, delivery, maintenance of the hot-tops, cleaning, etc. For the rammed lining account must also be taken of the labour for ramming or painting of the exothermic compound or the labour for making exothermic inserts, cleaning the feeder heads to remove burnt-on rammed material, etc., so that here the costs rise even higher than those for other heating methods with exothermic mixtures.

In general, with exothermic powders of the types known at the present time, dependent on the type and intensity of the heating of the exothermic powders, and according to the type of coating of the hot-tops, there is a consequent varying degree of reduction in the life of the hot-tops, so that the costs can thereby rise considerably. To an

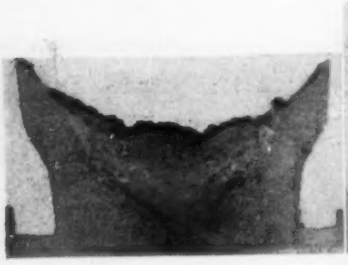


FIG. 44.—SULPHUR PRINT OF A SECTION THROUGH THE SAME FEEDER HEAD AS IN FIG. 43.

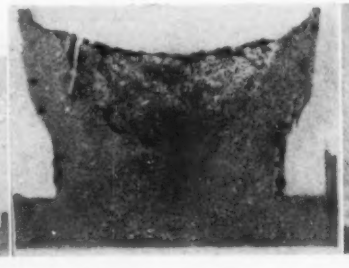


FIG. 45.—SULPHUR PRINT OF A SECTION THROUGH A FEEDER HEAD TREATED WITH A MIXTURE OF 20 PER CENT. NITRATE + 70 PER CENT. FeSi (75 PER CENT.) 10 PER CENT. CaSi.

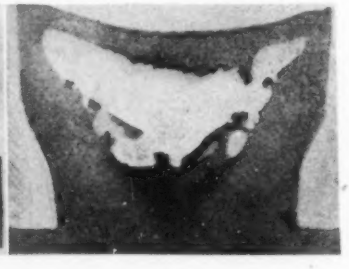


FIG. 46.—SULPHUR PRINT OF A SECTION THROUGH A FEEDER HEAD WITH A REVERSE TAPER (0.9-TON INGOT WITH H:D=4.0). TREATED BY SPRINKLING WITH POWDERED FIRECLAY.

TABLE 3.—*Comparison of the Effects of the Various Methods of Heating with Exothermic Mixtures.*

Type of exothermic mixture.	Dosage, kg/ton.	Ratio of ingot, H:D.	Cost of raw materials, Kcs/ton.	Reduction in weight of feeder head, per cent.	Cost of raw materials for 1 per cent. reduction in weight of feeder head per ton, Kcs.
65–75 per cent. FeSi + 20 per cent. $NaNO_3$ + 5–15 per cent. fireclay	1–1.25	3	3.5	2.3	1.50
70 per cent. FeSi + 20 per cent. $NaNO_3$ + 10 per cent. CaSi	1–1.25	4	4.00	2.0	2.00
36 per cent. $NaNO_3$ + 20 per cent. Si + 3 per cent. CaSi + 41 per cent. graphite	1–1.25	4	1.65	2.0	0.83
Thermit	4	2–4	7.00	2.5	2.80
Thermit (Imatra)	10	—	18.00	6.5	2.80
Exothermic, rammed lining with exothermic powder	9.1	2.75	15.85	6.6	3.50
"Without Thermit"	1.82	—	7.15	—	—

even greater extent, however, this applies to the increase in labour required on the teeming floor and the reduction in output.

Apart from costs for raw materials and preparation of the mixture, it will be practical for the use of exothermic powders to count on a further increase in costs of 1.5 to 3 Kcs./ton for 1 per cent. reduction in the weight of feeder heads. Costs for an exothermic rammed lining together with exothermic powder are increased by preparation of the rammed lining or of the exothermic inserts, by cleaning of the feeder heads, etc., to 4.50 to 5.50 Kcs./ton for 1 per cent. reduction in the weight of the feeder heads (27 to 35 Kcs./ingot ton).

What is the economic advantage of reducing the weight of the feeder heads? Smhra and Brodsky calculate the saving by means of the equation used by Johansson and Helin.[5] In accordance with this equation calculation is made with a fixed price of the crude steel (*i.e.*, of the charge per melting unit) and with a reduction in the conversion costs for melting, teeming, and mechanical working proportional to the increase in output. At the very low price for rolling mill or forging scrap, which favours its use in our steelworks, especially for alloy scrap, excessive savings through a reduction in top discard are out of the question.

If we are aiming at a real production gain, then it is necessary to assess the real economic advantage, and not the accountancy gain. Primarily, during the calculation presented no account at all is taken of the fact that by reducing the quantity of cheap scrap, its quantity in the charge is reduced, and thereby the charge of melting units becomes dearer. If we wish to assess the savings on the basis of the real output of economic production, then it is necessary to realize that the real saving on increasing the output is completely in relationship solely to the decrease in the conversion costs of melting, *i.e.*, each per cent. of reduction in the weight of the feeder heads utilized for increasing the output here implies a 1 per cent. reduction in the costs for melting in the appropriate sum converted into semi-finished product.

On the contrary, the costs for teeming are not decreased in proportion to the increase in output, since, for instance, the costs for ingot moulds per weight of ingots increase, or the level of costs for ingot moulds calculated in relation to semi-finished products remains constant. It is the same with the consumption of teeming stools, runner bricks, mould paints, etc. Likewise during rolling there is no decrease in the costs for the blooming mill proportional to the increase in output, since the rolling time is not proportional to the weight of the initial ingot.

From the aspect of real economics, therefore, it is correct to reckon that with carbon steels the costs for semi-finished products from the blooming mill are decreased only by 4.00 to 5.00 Kcs./ton semi-finished products per 1 per cent. increase in output. The costs for heating the feeder heads of ingots cannot exceed 3.00 to 4.00 Kcs./ingot ton per 1 per cent. utilized reduction in the weight of the feeder head or more correctly of the top discard.

From this point of view we see that the use of an exothermic rammed lining with exothermic heating "without Thermit" is wasteful for carbon steels, *i.e.*, increases production costs. Not without justification foreign steelworkers assert that *the use of exothermic linings for carbon steels does not pay for itself.*

Even exothermic mixtures, if the reduction in the weight of the feeder head attainable by heating is not fully utilized for increasing the output, do not afford a real economic advantage, *i.e.*, they are too expensive for carbon steels.

It is possible that within the framework of the state economy an increase in output can outweigh the increase in production costs. The use of an exothermic, rammed lining with an exothermic powder "without Thermit" does indeed bring savings with high-alloy steels, where use is made of various highly effective methods of heating, *inter alia*, electrical heating also, especially abroad.

The method set out affords a partial solution, which has no advantages over heating by means of Thermit, if we see why difficulties arose with the use of Thermit in the USSR, and if we know the way to a simple safeguard against the occurrence of so-called white spots.

The heating method by the use of an exothermic, rammed lining, developed by the authors and con-

firming results from abroad, and the equally effective use of Thermit mixtures, which have the advantage of lower costs and greater suitability for industrial use, and which may be used for high-alloy steels, are neither of them, however, able to relieve us of the *basic problem of increasing output over the whole range of production of killed steels, by means which are cheap, applicable under production conditions and highly effective.*

It is necessary to bear in mind that neither do other methods of heating, for instance by electricity, oxy-gas flame and even oxygen, although they are substantially cheaper and just as effective as the use of an exothermic lining and powder, yet independently solve the problem of decreasing the top discard from ingots. The solution sought for can originate only from the complex solution of a whole collection of problems of teeming, solidification, and ways of influencing it, cleaning of ingots and their mechanical working in the blooming mill, both on the technological and purely production sides.

To the authors must be expressed recognition for a good paper and the attempt at a more objective assessment of the results, which did not apply, for instance, to the method of C. Duchona and to the use of exothermic mixtures at the Old Steelworks in Vitkovice, but one must see that this has not served to remove lack of clarity of opinions concerning feeder heads, but that here also a new danger has arisen of accepting a partial-solution at the expense of a comprehensive, general solution of the problem of increasing the output of steel.

It is pertinent to stress the fact that far less attention is devoted to problems of casting technology than to other problems of steelmaking.

REFERENCES

[1] Yefimov, Stal, 1959, No. 8, p. 706 (Stal in English, 1959, p. 594).
[2] Aitken, Fletcher, and Fenton, J. Iron Steel Inst., 1958, 12, p. 349.
[3] S. Kubena, Hutnik, 1958, No. 9, p. 293.
[4] Zhetvin, *et al.* Stal', 1957, No. 7, p. 587.
[5] Johansson and Helin, Stahl und Eisen, 1955, No. 26, p. 1,755.

REPLY BY THE AUTHORS

We welcome the discussion article of N. Chvorinov, a competent research worker on metallurgical foundry work. Problems of the treatment of feeder heads are increasingly practical, as is shown by numerous foreign publications, patent literature, and conferences arranged on this subject in the USSR, western Germany, etc.

In our article, to which we gave the title "Influencing the Solidification of Ingot Feeder Heads by Means of Exothermic Powders and Linings," we were not fundamentally concerned with a theoretical solution of the problems of feeder heads, namely on the following grounds:—

(1) As we have already stated in the introduction to our paper, the problem of a complex solution of the problems of feeder heads is very extensive, and demands at least a separate publication; (2) the theoretical solution has already been the subject of several authors' papers, especially Soviet authors and also N. Chvorinov[1]; (3) our article is an expanded version of the lecture given in December of last year in Ostrava, where, likewise, a research report of the author of the discussion article from the United Steelworks in Kladno was originally read. In order to avoid complete duplication of our reports, we *deliberately* avoided a theoretical analysis of the problem in our lecture.

Since our article discusses a partial problem, it is evident that it demands of its readers a certain basic knowledge in this particular branch of the subject. This implies, for instance, the influence of the chemical composition of the steel and especially of carbon on the kinetics of solidification[2, 3, 4] and thereby indirectly on the size of the feeder head, and, in addition, the effect of temperature, method and rate of teeming, etc. *On the grounds set out above we deliberately did not deal with the effect of the dimensions of the feeder head and of the ingot on the size of the critical feeder head,* which is a subject for theoretical analysis. It is also necessary to say that the theoretical solution has great importance for the assessment of the effect of very varied factors on the size of the feeder head of an ingot, but on purely production grounds many conclusions of the theoretical solution remain unheeded to the present day. We consider that by means of normal mathematical expedients it is impossible to determine with complete reliability the absolute values of the weight of feeder heads for the very varied conditions of teeming steel, and it is therefore necessary to reckon on a certain error (reserve), which is produced, for instance, by lack of knowledge of accurate values of the shrinkage of steel for various ingot shapes, of the deformation of the solidifying skin of the steel, etc.

It is likewise self-evident that it is impossible to establish equality between the concept of the weight of a feeder head and the actual top discard. But if it is a matter of comparing the effects of various methods of heating feeder heads with essentially the same types of ingots, as we have done in Table 2, then it is a matter of direct proportionality between the weight of the feeder head and the weight of the top discard.

The minimum size of feeder head given by us as 9.6 per cent. for a VI A ingot was intentionally calculated somewhat on the low side. In agreement with results in the literature[5] we took into account a weight of the feeder head of 10.5 to 11 per cent. Since at the New Klement Gottwald Steelworks for an ingot with a ratio H:D=2.5 the average top discard is 9.6 per cent. during top pouring, we took this value as a basis. In this way, on the other hand, we showed the economic results of treatment of ingot feeder heads with exothermic powders in a worse light, as Table 2 shows.

A certain misunderstanding has occurred on the part of the author of the discussion article in assessing the results in Table 2, namely in relation to ingots treated only with exothermic powder "without Thermit." The text quoted relates only to ingots from one melt (see Figs. 26 and 27). Apart from combined heating with an exothermic, rammed lining, and exothermic powder we also

TABLE 4.—*Percentage Chemical Composition of Specimens from the Feeder Head of an Ingot Treated with Exothermic Powder "Without Thermit".*

No. of specimen	C	Mn	Si	P	S	Al
1	0.18	1.30	0.23	0.023	0.018	0.010
2	0.21	1.32	0.23	0.022	0.019	0.010
3	0.19	1.28	0.22	0.021	0.019	—
4	0.19	1.31	0.23	0.023	0.017	under 0.005
5	0.18	1.29	0.23	0.024	0.017	0.008
6	0.19	1.26	0.22	0.022	0.016	0.007
7	0.17	1.31	0.22	0.024	0.018	0.008

concerned ourselves with the problem of heating ingot feeder heads with exothermic powder only, and, in fact, mainly with exothermic powders based on granular aluminium material. In the section on "Powders Not Containing Thermit" are set out briefly the results obtained, the average consumption of exothermic powder, the costs per ton of steel, and in Fig. 1 is the feeder head of an ingot treated only with exothermic powder "not containing Thermit" (unfortunately, the photograph as reproduced and decreased in size is not easy to see*). On the basis of the experiments reported in our article we came to the same conclusion as that stated by Chvorinov, that exothermic mixtures based on ferro-alloys require an accurate technique; otherwise deterioration of the material occurs and there is danger of contamination of the axial part of the ingot, as is confirmed by the photographs in Figs. 40, 43, 44, 45, and 46 of the discussion article, apart from other disadvantages. Therefore, we have proposed exothermic powders "without Thermit," but containing aluminium as the active component, which undergoes combustion with atmospheric oxygen, and not with oxygen combined in iron oxide.

These powders do not contaminate the feeder head and that part of the ingot below it; in Fig. 47 is a sulphur print of the feeder head of an ingot weighing 2 tons. The results in Table 4 and the sulphur print confirm that the composition of the steel is not affected even in the ingot feeder head by the exothermic powder. The narrow zone of liquidation at the top does not exceed the normal extent.

It is therefore necessary to supplement the table of Chvorinov in relation to the exothermic powder designated "without Thermit" (see Table 5).

From Table 5 may be seen the resultant advantages of the use of exothermic powder based on aluminium "without Thermit"; the raw material

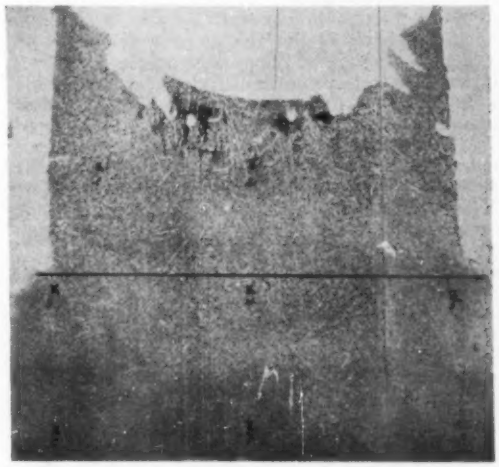


FIG. 47.—SULPHUR PRINT OF THE FEEDER HEAD OF A 2-TON INGOT TREATED WITH EXOTHERMIC POWDER NOT CONTAINING THERMIT.

costs for 1 per cent. saving in steel, per ton crude steel, are lowest for this type of powder, if we disregard powder containing graphite and containing an excess of FeSi, which however, has the dis-

* This does not apply to the reproduction made in England, from an original, not from the journal.

TABLE 5.

Type of exothermic mixture.	Dosage, kg/ton.	Ratio of ingot H:D.	Cost of raw materials Kcs/ton.	Reduction in weight of feeder head, per cent.	Cost of raw materials for 1 per cent. reduction in weight of feeder head per ton. Kcs.
5–75 per cent. FeSi, 20 per cent. $NaNO_3$, 5–15 per cent. fireclay	1–1.25	3	3.50	2.3	1.50
70 per cent. FeSi, 20 per cent. $NaNO_3$, 10 per cent. CaSi	1–1.25	4	4.00	2.0	2.00
36 per cent. $NaNO_3$, 20 per cent. FeSi, 3 per cent. CaSi, 41 per cent. graphite	1–1.25	4	1.65	2.0	0.83
Thermit	4	2–4	7.00	2.5	2.80
Thermit (Imatra)	10	—	18.00	6.5	2.80
Al exothermic powder "without Thermit"	2–2.5	2.7	9.30–11.60	4.5–6	1.75–2.33
Exothermic rammed lining + Al exothermic powder "without Thermit"	1.82	—	7.15	—	—

advantages stated earlier and lower efficiency. Powder not containing Thermit has this further advantage that it does not destroy the lining of hot-tops to the same extent as powders containing ferro-alloys and Thermit. The reaction also takes place gradually and does not cause the formation of an aggressive slag or a solid insulating substance.

In our paper, for calculation of the savings we used the conventional equation,[6] which in our opinion is suitable, if we wish to compare the savings obtainable by various methods of heating feeder heads, and is relatively simple. It is obvious that it does not comprehend the economic results of conducting the heating of ingot feeder heads over the whole field. It does not include, for instance, changes in conversion costs, changes in the composition of the charge of a melting unit, savings in alloying additions with different amounts of loss through combustion, etc. So far as the prices of scrap and pig-iron are concerned, their quantities and consumption in the charge would change with the complex conduct of the technique of heating feeder heads, and today it is impossible to express accurately the economic results of these changes either by calculation or in reality, since especially with the prices of pig-iron one may expect a considerable reduction. Moreover, if we convert the savings in Table 5 to 1 per cent. increase in output, starting from an original weight of the feeder head of 11 per cent., the resultant figure for the exothermic powder containing Thermit is 4.80 Kcs./ton and for the powder not containing Thermit 6.60 Kcs./ton.

These savings we do not consider to be exaggerated, but on the contrary as conservative; Chvorinov[7] states for unalloyed, carbon steel a saving of 6 to 7.50 Kcs. per ton of semi-finished product per 1 per cent. increase in output.

In our article we came to the unambiguous conclusion that the heating of feeder heads with exothermic, rammed linings should be used only "for a small part of the production of alloy steels," and there is therefore no foundation for the opinion of Chvorinov, contained in the conclusions of his discussion article, that "a danger has arisen of accepting a partial solution at the expense of a comprehensive, general solution of the problem of increasing the output of steel."

In the interests of clarity we once again summarize the basic points of our article:—

(1) In the first part we deal with the heating of ingot feeder heads with exothermic powders, at the same time dividing them into three classes. As the most suitable on the metallurgical side and from the aspect of economics, we recommended for wider use an exothermic powder based on aluminium, developed by us and designated "without Thermit,"[8] to the development and application of which sufficient attention has not hitherto been devoted.

(2) The use of exothermic rammed linings (inserts) is justified only for a relatively small part of the production of alloy steels.

(3) On account of their highly effective action two-layer shapes consisting of insulating and exothermic materials are suitable for development.

(4) The use of synthetic binder materials revealed new possibilities for the production of shaped sections for hot-tops.

Thus far we supplement the opinion of Chvorinov, who in his discussion article addressed himself only to the problems of exothermic, rammed linings, and thereby restricted the field of problems solved by us.

The author of the discussion article further states in the conclusions that "the method of heating through the use of an exothermic, rammed lining is not, however, able to relieve us of the basic problem of increasing output over the whole range of production of killed steels by means which are cheap, applicable under production conditions and highly effective." Unfortunately, Chvorinov does not define more closely these means, so that we cannot adopt a clear attitude to his opinion.

In our opinion there are today several methods of carrying out economies in the technology of casting steel. Among the most important are: continuous casting; semi-killed steel; a special method of teeming steel-ingots without feeder heads—irrigation with water with subsequent "final pumping."

The first demands expensive casting plant and so far has been applied abroad only to an extremely small proportion of the steel produced. The last two methods are the subject of research abroad and in our country it is probable that their extension can be expected only for unalloyed steels; for casting semi-killed steels it is necessary to reckon on mechanical plant for cleaning the surface of the ingots.

These problems were in no way the subject of our article.

We agree with the opinion of Chvorinov that in general in our country substantially less attention is paid to problems of casting technology by comparison with abroad. We have drawn attention to this contradiction on very varied occasions.[9] Planning of main research projects originates for the most part from momentary, and sometimes very narrow economic considerations, and so it comes about that extensive research into those problems, whose solution is not quite obviously in the stage of being accepted becomes impossible. Casting problems have been centrally co-ordinated by the Czechoslovak Academy of Science—by the Secretariat for State Planning of Research—for only a year. Formerly the work was not co-ordinated, and the problems were split up and distributed to several work places without operative direction and control.

The discussion article acted as a very good spur, not only for us but also for all interested research workers, and further brought about clarification of certain further problems dependent on these particular problems. At the same time it has been shown how wide is the task of treating ingot feeder heads, and that the complex conduct of

the technique of treating feeder heads at the same time demands technical and organization at handling. It is desirable that within our research framework greater attention should be devoted to the whole problem than hitherto.

REFERENCES

[1] N. Chvorinov: "An Analysis of the Determination of Feeder Head on Ingots and Castings" (Rozbor reseni ztracenych hlav ingotu a odlitku), Report, 1953.
[2] Bishop, Brandt, Pellini, J. Metals, January, 1952, p. 44.
[3] W. S. Pellini, Proceedings of Electric Furnace Steel Conference, 1956, pp. 48–90.
[4] L. Smrha, Hutnicke Listy, 1959, No. 12, p. 1,039.
[5] M. Shield, Stahl und Eisen, 1956, No. 19, pp. 1,253–1,254.
[6] Johansson and Helin, Stahl und Eisen, 1955, No. 26, p. 1,755.
[7] N. Chvorinov, see reference 3 on p. 1404.
[8] L. Smrha and I. Brodsky, "The Capacities of Exothermic Mixture Based on Aluminium and its Alloys to Influence Solidification." At press.
[9] L. Smrha, Final Research Report, "Improving Ingot Casting Technology", 1958.

Forthcoming Events

JANUARY 3

Institution of Plant Engineers (Southern Branch):—Meeting at the Polygon Hotel, Southampton, at 7.30 p.m. Forum on "Engineering Education and Training."

JANUARY 4

Institution of Mechanical Engineers (Eastern Branch):—Meeting at the Sun Hotel, Hitchin, at 7.30 p.m. "Powder Metallurgy Applications," by B. H. Swan.

Institution of Mechanical Engineers (Midland Branch):—Meeting at the James Watt Memorial Institute, Great Charles Street, Birmingham, at 6 p.m. Repetition of the James Clayton Lecture: "Machine-tool Research, Design, and Utilization," by Dr. D. F. Galloway.

JANUARY 6

Institution of Production Engineers (Wolverhampton Section):—Meeting at Wolverhampton and Staffs College of Technology at 7.15 p.m. "Recent Developments in Automatic and Semi-automatic Welding," by L. H. Morgan.

National Association of Colliery Managers

JANUARY 8

South Midland Branch:—Meeting at Ashby Rescue Station at 4 p.m. Paper by W. A. Wood, chief safety engineer, National Coal Board.

JANUARY 16

Yorkshire Branch:—Meeting at the Miners' Welfare Hall at 3 p.m.

JANUARY 17

North of England Branch:—Meeting at the Mining Institute, Westgate Road, Newcastle-upon-Tyne. "Dust Extraction and Filtration in Continuous Miner Workings," by Dr. J. Gibson and J. C. Sproson.

JANUARY 22

Midland Branch:—Meeting at Bentinck Colliery Welfare Institute at 6.30 p.m. Paper by J. Atkinson, deputy Area production manager, Area No. 4, East Midlands Divisional Coal Board.

JANUARY 24

North Staffs Branch:—Meeting at the Mining Industry Offices, Leek Road, Stoke-on-Trent, at 6.30 p.m. "Materials Handling," by Dr. W. R. Cheetham.

Lancashire Branch:—Meeting at the Literary and Philosophical Society, 36, George Street, Manchester, at 4 p.m. "The Needs and Hopes of the Safety Year 1962," by W. A. Wood, chief safety engineer, National Coal Board.

CONSTRUCTION OF a wide strip mill is reported to be planned by Bochumer Verein (part of the Krupp concern), which has already submitted the project to the High Authority of the ECSC, states Handelsblatt, Düsseldorf. Thus, in addition to the three wide strip mills already in production in Germany, four new mills are now planned—at August Thyssen-Hütte, Salzgitter, Mannesmann, and Bochumer Verein.

New Literature

READERS wishing to obtain a copy of any of the house magazines, catalogues, brochures, and other publications referred to below should write to the address given, at the same time mentioning this journal.

SOLUS-SCHALL, LIMITED, County Building, Honeypot Lane, Stanmore (Middx)—Articles on "Ultrasonic Testing of Cast Iron" and "Ultrasonic Examination of Spiral Seams" are among the features of the November issue of the S.S. News Letter.

CATALIN, LIMITED, Waltham Abbey (Essex)—Formed in 1936, the year which marked the dawn of the plastics age, the company has this year celebrated its silver jubilee. It has also published "Catalin: Catalyst to Industry," a booklet outlining how the company has been able to serve a wide variety of industries—coal mining, foundry, motor car, and others.

STEWARTS AND LLOYDS, LIMITED, Brook House, Upper Brook Street, London, W.1—There's a distinctly seasonal flavour about the December issue of the Review News, the monthly newspaper for S&L employees, Radio Times Hulton Picture Library having helped out by providing a number of interesting and decorative illustrations. W. H. Owens writes on "Pantomime," "F.C." contributes "Birthday," a moving short story, while there is the usual selection of news of the group.

SANDERSON BROS. & NEWBOULD, LIMITED, Newhall Road, Sheffield—A leaflet describes the progressive teeth hacksaw blades recently introduced by the company. The new product is so called because the teeth "progress" from a fine pitch at one end to a coarser pitch at the other, this providing a versatile blade suited to all kinds of jobbing work. Progressive teeth hacksaw blades are now being produced as an addition to the company's existing range and are not intended to replace any standard type of hand hacksaw blade.

HEAD, WRIGHTSON & COMPANY, LIMITED, Teesdale Ironworks, Thornaby-on-Tees (Yorks)—"We have been watching the development of the Common Market carefully and, if Britain does join, I feel that it will be the biggest challenge that British industry has had to meet," says the chairman, Sir John Wrightson, in the December issue of Wright Ahead. He adds: "For our part, I feel that with our modernized works, quality workmanship, advanced techniques, and continuous research and development, we are poised to make a tangible contribution on a healthy competitive basis to the world and Common Markets."

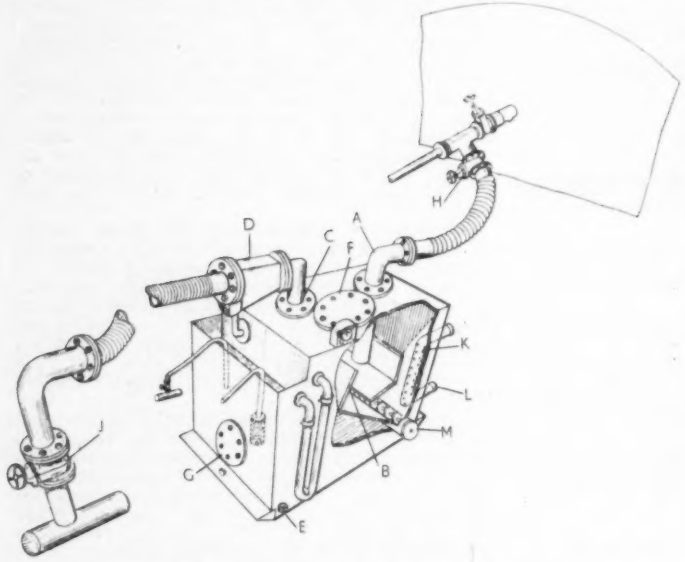
BUTTERLEY COMPANY, LIMITED, Butterley, Derby—The breaking-up of HMS Agincourt in 1960 revived the story of the Butterley Bulb—of which revolutionary shipping design the Agincourt was a leading example—and of its inventor, Sir John Alleyne. The story of the Agincourt and her many-sided career is told in the autumn number of Ad Rem. "Higher Foundry Productivity" describes the completion of the second phase of the large-scale foundry modernization which is proceeding at Butterley. This phase covers sand storage and the installation of a moulding machine section. Other items of interest include Butterley's contribution to the New North Works of Shelton Iron & Steel, Limited. Considerable attention is paid to the layout and general production of Ad Rem, which can claim to be among the best of the publications in its field.

DRILLING SEPARATOR TANK

WHEN a borehole is drilled in a mine for firedamp drainage purposes, sudden heavy emissions of gas occasionally occur while drilling is in progress. A method has been required of collecting the gas coming from the borehole and leading it away in a pipeline without interfering with the drilling operations, and also of enabling the flushing water used for drilling to be in a closed circuit.

To meet these requirements a separator tank has been designed by the National Coal Board's ventilation branch. Its purpose is to separate the flushing water, gas, and drillings discharged from a borehole. The return flushing water, cuttings, and firedamp enter the tank, which is 4 ft. 6 in. long, 2 ft. 3 in. wide, and with an overall height of 4 ft., at the inlet A which is connected to the outlet of the stuffing box by means of a suitable length of hose.

The cuttings settle to the bottom of the enclosed section of the tank, while the flushing water flows over the baffle plate B, through the U-tube assembly to the open section of the tank. Firedamp is drawn from the enclosed section of the tank through the outlet C and the water separator assembly D, and then via a flexible connection to the firedamp drainage range.



SEPARATOR TANK DESIGNED BY THE VENTILATION BRANCH OF THE NATIONAL COAL BOARD.

The suction hose of the water flush pump is inserted into the open section of the tank while the delivery hose of the pump is connected to the drill water swivel assembly. Make up water can be added as required to maintain the recommended level. The U-tube assembly provides a 27-in. water seal between the enclosed and open section of the tank. A pressure gauge having a range +3 to −3/sq. in. gauge indicates the pressure of the gas in the enclosed section of the tank. A drainage plug E and inspection plates F and G are provided.

Cuttings are removed from the tank by means of a scraper after drilling has finished and when valve H and valve J have been closed. Before the cuttings are removed the water in the enclosed section is drawn off through the small perforated pipe K by opening valve L. The screw cap M is then removed and the cuttings can be raked out.

Iron-ore Beneficiation Research in Czechoslovakia

SELECTED papers of the Ejpovice Research Institute of Iron Mines and Renn Plants, published in the 1960 volume, are printed in Czechoslovak, but there are summaries in English, German, and Russian. Copies are obtainable from Dr. Milan Doležil, Mníšek pod Brdy-sídliště, Czechoslovakia.

The following papers are included in the volume:—

"Treating Albanian Leach Residue by Krupp-Renn Process," by V. Rybář and J. Drexler; "Treating Yugoslav Chamosites by the Krupp-Renn Process," by J. Mach, Z. Avrat, V. Rybář, and J. Drexler; "Treating Copper Slag by Krupp-Renn Process," by J. Drexler and O. Kocna; "Granulating Drum," by Z. Avrat and J. Mach; "Comminuting Krupp-Renn Slag in an Impact Mill," by V. Rybář and V. Dostál; "Magnetic Roasting of Bulgarian Limonites," by J. Novák, J. Chvatík, and M. Doležil.

"Beneficiation of Egyptian Iron Ores," by J. Chvatík; "Modified Shaft Furnace for Magnetic Roasting," by J. Novák; "Dry Three-phase Magnetic Separator," by P. Alexander; "Contribution to the Study of Different Flotation Characteristics of Pyrites from Chvaletice," by J. Fanta, J. Bulandr, M. Doležil, V. Hoffman, and Z. Trdlička; "Complex Treatment of Copper-Siderite Ore from the Locality Maria Baña," by M. Doležil and J. Bulandr.

HYDRAULIC DRILLING IN HEADINGS

Trials at Hucknall Colliery

SUCCESSFUL trials with a power pack to operate six hydraulic rotary drilling machines have been carried out at Hucknall Colliery in No. 6 Area of the East Midlands Divisional Coal Board, where a major reconstruction scheme is being undertaken involving the complete reorganization of the surface and the development of a new pit bottom to work the Deep Soft Seam.

The strata in which the new pit bottom is being made were of medium hardness and capable of being drilled by rotary boring machines, thus allowing the round of holes for each pull to be drilled at faster rates than would be possible if percussive machines were used. To take full advantage of this type of strata it was decided to increase the number of boring machines used in each drivage.

The use of compressed air was rejected as being inefficient and beyond the capabilities of the surface plant. Inbye compressors for providing the necessary compressed air were also dismissed, for each unit would require a fairly extensive installation and would not provide the flexibility required in the drivage of a large number of roadways of relatively small length.

Electric rotary drilling machines were also considered impracticable for each machine would require its own transformer/switchgear unit, involving the installation of a maximum of six units for each drivage. The application of supporting legs to obtain the maximum thrust for drilling the envisaged 10-ft. holes and to reduce operating fatigue was considered essential and this was not possible with either compressed-air or electric rotary drilling machines because of the tendency of these machines to twist when the drill bit becomes jammed.

Hydraulic Power Unit

These factors led to the decision to use hydraulic drilling machines and the need for a single power unit from which the six machines could be operated. The hydraulic power pack, designed and made by Richard Sutcliffe, Limited, Horbury, Wakefield (Yorks), is based on six power units each operating independently and driving six Gladiator drilling machines.

The six cam-type hydraulic pumps, in which a cylindrical rotor, fitted with flat sliding blades, rotates eccentrically in the pump housing, are driven from a common shaft powered by a 25-h.p. motor rotating at 1,440 r.p.m. Each pump draws its oil supply from a common 90-gal. tank into which the return lines from the drilling machines also discharge. The drilling machines are supplied with oil by 30-ft. feed lines, the delivery and return lines being ½ in. nominal bore.

Although the power pack is capable of developing a pressure of 2,000 lb./sq. in., a relief valve is fitted to limit the pressure within the circuit to 1,250 lb./sq. in., giving a maximum power output at the drilling machine of approximately 5 h.p.

The drilling machines are supported by a hydraulically-operated leg, shown in Fig. 1, which is designed to accept the drilling machine in the bracket at the top of the leg. With the drill rod offered to the rock face and the opposite end pressed firmly into the ground, thrust can be applied to the drill by operating a small orifice valve. Although the leg is suitable for hydraulic oil or soluble oil and water, it can be operated from the colliery water mains. The unit, weighing 55 lb., is double acting which enables it to be reset quickly. A 2-ft. 6-in. extension can be fitted for drilling top holes.

FIG. 1. — HYDRAULIC DRILLING LEG FOR USE WITH EITHER OIL, SOLUBLE OIL, AND WATER OR MAINS WATER.

The safety devices which have been fitted to the power pack include a Londex float switch, to ensure that if the normal oil level falls below a specified minimum the electric motor cuts out, and a thermostat to prevent overheating.

Providing Traction

The prototype unit (Fig. 2), in which the electric motor and the hydraulic pumps were on the oil tank, was floor mounted, the tank resting on the floor and forming the base for the moving parts. The unit was dragged along the floor when the limit of the feed lines was reached. Since the initial trials with the prototype power pack, the motor, pumps, and reservoir have been rearranged and mounted on a four-wheel bogie fitted with solid rubber tyres (Fig. 3). The chassis of the bogie has been cranked to lower the centre of gravity of the unit.

A further important

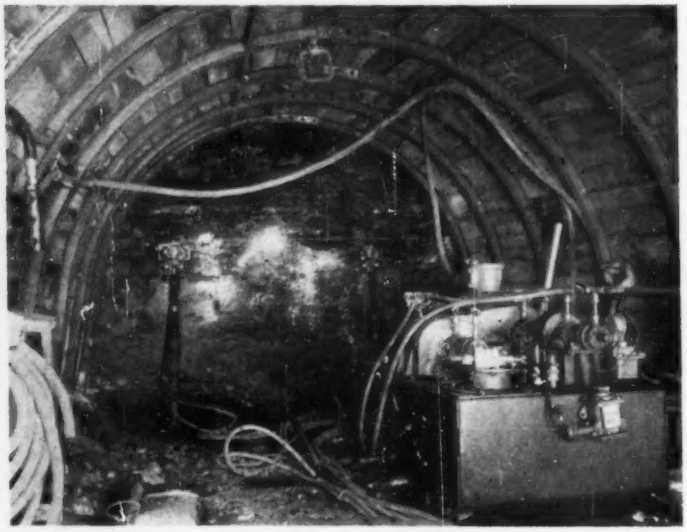


FIG. 2.—PROTOTYPE POWER PACK UNDERGOING TRIALS AT HUCKNALL COLLIERY.

development has been to provide traction by fitting an oil-driven motor, powered by an auxiliary circuit from one of the oil pumps. This modification enables the power pack to be moved by one man. When it is required to move the unit, a valve, operated by a cable and spring-loaded throttle lever mounted on the steering handle, allows the oil to drive the traction motor.

The torque to the rear driving wheels is transmitted by a Renold chain and pinion. The spring loading of the throttle lever offers a safety measure, for should the operator stumble or fall, the release of the throttle lever immediately stops the oil flow to the driving motor. It has been found that the traction motor will haul the power pack up a maximum gradient of 1 in 10. A shield has also been fitted to protect the unit from flying debris during shotfiring operations.

Initial trials with the prototype unit took place in a 14-ft. by 10-ft. roadway being driven to provide access for dirt and materials to be wound up the No. 5 shaft, which has been sunk as part of the major reorganization and which will eventually be fitted with skip-winding plant to raise the main bulk of the output.

The roadway is 60 yd. long and toward the end of the trials, a 10-ft. pull was being obtained. 42 holes being drilled and charged with 90 lb. of Ajax explosive. The drilling time for the round, bored for a Burn cut, was 2 hr. 15 min. and was completed by four men each with a drilling machine. After the blasting, the round was loaded out into tubs holding between 14 and 15 cwt. of stone by a gathering-arm M&C3 loader. Towards the completion of the drivage, an advance of 10 ft. per shift was being obtained.

During the trials, the hydraulically operated drilling machines offered a number of advantages, probably the most noticeable being the low noise level of the machines. It was found that the tunnelling team could converse in a normal voice and commands could be given without having to stop the drilling machines. In addition, higher penetration speeds were obtained because of the higher power available at the drilling bit, compared with either compressed-air or electrically operated boring machines. The time taken to drill a 10-ft. hole was found to be between 90 and 110 sec.

Improved stalling characteristics also resulted from the relief valve in the circuit. When the drill bit became jammed, the pressure in the individual drill circuit increased until the relief valve operated, cutting off the flow of oil to the machine. Thus, there was no reactionary twisting of the machine as is normally experienced with both compressed-air and electric rotary machines. The absence of exhausting compressed air or the draught from the cooling fan of an electric motor limited the amount of dust raised into the air.

The removal of the power-producing unit from the drilling machines has also resulted in consider-

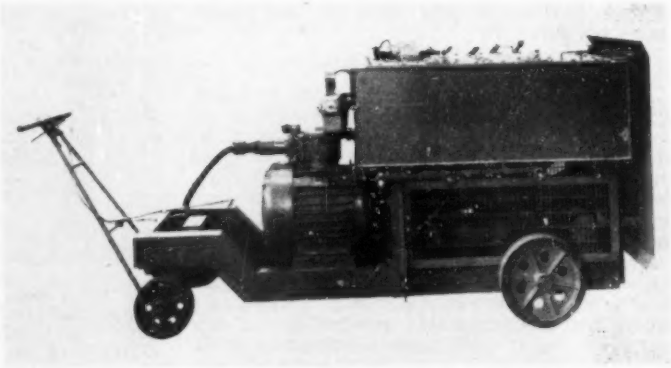


FIG. 3.—BOGIE-MOUNTED POWER PACK FITTED WITH TRACTION TO NEGOTIATE GRADIENTS OF 1 IN 10.

able saving in weight. The Gladiator drilling machine for boring in stone weighs only 36 lb. compared with 58½ lb. for a percussive machine powered by compressed air. A further hydraulic machine is being developed which it is hoped will weigh only 26 lb. Maintenance of the drilling machine was found to be almost negligible since the machines are self-lubricating.

Acknowledgment is made to Mr. N. R. Smith, general manager, No. 6 (Bestwood) Area, East Midlands Divisional Coal Board, for permission to visit the Hucknall Colliery, and to his staff for its assistance in preparing this article.

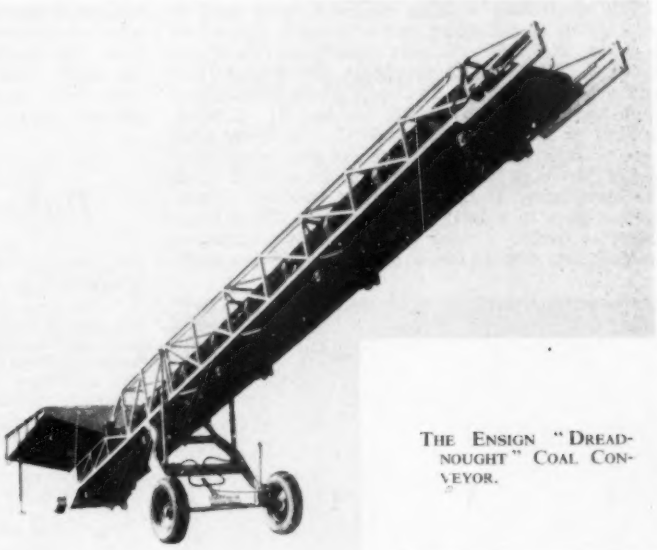
Thanks are also expressed to Richard Sutcliffe, Limited, for providing some of the technical information.

New Coal Conveyor

RECENT addition to the range of equipment manufactured by the Ensign Conveyor Company, Limited, Midland Works, Meadow Lane, Nottingham, which forms the materials handling division of Thos. W. Ward, Limited, is a mobile electrically operated coal conveyor, the Ensign "Dreadnought," which handles coal up to 8 in. size and stockpiles up to 20 ft. high.

The boom is 36 ft. long between pulley centres and is constructed of securely braced and welded girders. The undercarriage is fitted with hydraulic jacks and can be adjusted to any height between the maximum and minimum. Pneumatic wheels are fitted. The squirrel cage drive, totally enclosed geared motorized head pulley, is for operation on standard a.c. supply. The 24-in. wide belt, made of rubber and canvas, is fitted with 1-in. high retarding cleats at 2 ft. pitch. The feed-boot is made of mild-steel plate, it is 8 ft. 6 in. high with a hinged back flap, for feed by tipping lorry at control rate.

The Thos. W. Ward materials handling division supplies individual components as well as the design and construction of complete handling schemes.



THE ENSIGN "DREADNOUGHT" COAL CONVEYOR.

Use of Fire-resistant Hydraulic Fluids

FIRE-RESISTANT hydraulic fluids approved by the Bureau of Mines, US Department of the Interior, for use in underground coal mines are not only safer, but often are cheaper and more efficient than flammable-oil fluids. A technical report released by the department summarizes the first year of widespread mining experience with the new fluids, developed through co-operative research by the bureau and industry. The studies were concentrated primarily on the economical "water-in-oil" emulsion type now made by several manufacturers.

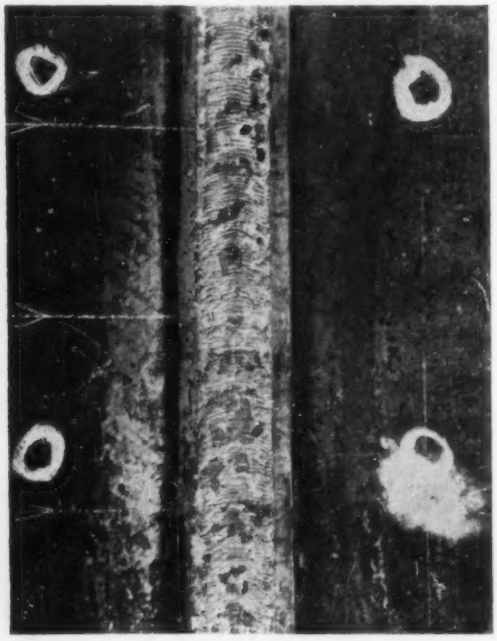
In addition to relatively low cost, the publication says, emulsion-type fluids have the following advantages over other types:—Higher viscosity, which reduces leakage; lighter colour, making leaks easier to spot; lower operating temperatures.

The need for safer fluids became apparent several years ago. Growing use of large mining machines, containing 50 gal. or more of flammable hydraulic oil under high pressure, had introduced a new fire hazard underground. The oil industry and certain large manufacturers and users of hydraulically controlled mining machinery joined with the bureau in 1956 to find a solution to the problem. This work culminated in 1959 with the publication of the Bureau of Mines Schedule 30, prescribing standards under which the bureau now tests hydraulic fluids for approval as "permissible" for safe use underground. Information Circular 8043, "Recent Developments in Fire-resistant Hydraulic Fluids for Underground Use," which can be obtained from the bureau's Publications-Distribution Section, 4,800, Forbes Avenue, Pittsburgh 13, Pa.

Electroslag Welding of Boilers

BY using electroslag welding for the longitudinal seams of the heat exchangers for the Dungeness nuclear power station, Head Wrightson is pioneering the application of electroslag welding in the field of Class 1 pressure vessels. This achievement has been made possible by co-operation between Head Wrightson Teesdale, Limited, the manufacturing company, and the company's research and development division, which has enabled the many technical problems to be overcome successfully.

The electroslag welding machine being used is of Russian manufacture and is the only one of its type in the UK. It was purchased via Esab, Limited, which is also supplying the welding wire and flux being used. The shell plates of the heat exchangers are between $2\frac{15}{16}$ in. and $3\frac{7}{8}$ in. thick in steel to BS 1501-161, Grade C. Each tier consists of four plates (*i.e.*, there are four electroslag welds per tier), and is furnace normalized after the completion of the electroslag welding. There are six tiers to a heat exchanger and the circumferential welds joining together the electroslag welded tiers will be made by submerged-arc welding. All the welds are subjected to 100 per cent. radiography, and, in addition, ultrasonic inspection will be carried out on all welds in plate thicknesses greater than $3\frac{1}{2}$ in.



SURFACE APPEARANCE OF ELECTROSLAG WELD IN TIER; PLATE THICKNESS $3\frac{1}{2}$ IN. FABRICATION BY HEAD WRIGHTSON TEESDALE, LIMITED.

The completed heat exchangers will be 75 ft. long by 23 ft. 6 in. I.D. The design code is BS 1500 and the working pressure 295 lb./sq. in.; the temperature being 420 deg. C. at the gas inlet end (shell thickness $3\frac{7}{8}$ in.) falling to 342 deg. C. at the gas outlet end (shell thickness $2\frac{15}{16}$ in.).

It is now rather more than 12 years since the electroslag welding process was developed in the USSR. Despite the many apparent advantages of the process in the welding of thick plate the Western countries have been slow to take it up, and it has only been over the past three years that British fabricators have been showing increasing interest in electroslag welding. Up to the present the only applications of electroslag welding in the UK have been in the field of general engineering where the welds have not been subjected to the rigorous inspection requirements appertaining to Class 1 pressure vessels.

Ruhr Coke Ovens in Production

FIRST part of Kokerei Zollverein (Rheinelbe Bergbau A.G. Gelsenkirchen (Ruhr)) in Essen-Katernberg started producing coke in September. These new coke ovens, planning for which began in 1956, have a total production capacity of more than 1,800,000 tons of coke a year. The plant will also produce some 30,000,000,000 cu. ft. of gas, 80,000 tons of crude tar, 22,000 tons of ammonium sulphate, 18,000 tons of benzole, and 14,000 tons of sulphuric acid a year. The works has been designed with an eventual increase in capacity of 50 per cent. in mind; that is, a daily production of 7,500 tons of coke with the corresponding quantities of by-products.

The coke ovens, of Still construction with 6 m. chamber height, incorporate the latest design features and are expected to achieve important economies, especially in labour costs. At present the plant is operating at half its designed throughput, four batteries (each of 24 ovens) having been lit up in June of this year and put to work so as to produce 2,500 tons of coke a day.

This coking plant is situated near the Zollverein coal mine, from which 80 per cent. of the coal carbonized at the plant is delivered direct by conveyor belt, while most of the coke produced will meet the increasing demand of the Hüttenwerke.

CANADIAN IMPORTS of chrome ore (chromite) increased in 1960 for the second consecutive year; they totalled 59,023 tons valued at $1,521,812. Consumption of ferro-chrome was slightly higher than in 1959, but exports of ferro-chrome, at 4,611 tons, were the lowest since 1943, when they were first listed as a separate export item. A 677-ton increase in the consumption of ferro-chrome was due to an increase in the production of stainless steel. Canada has no known deposits of commercial-grade chrome ore.

Introduction of

NEW HYDRAULIC PROP

FIG. 1.—THE "PATHFINDER" HYDRAULIC PROP.

AFTER two years' research and development in the field of hydraulic roof supports, the Mastabar Mining Equipment Company, Limited, Church Bank Works, Church (Lancs), has introduced the "Pathfinder" Mark IV range of hydraulic props. The series of props has undergone the testing and proving programme laid down by the National Coal Board and has been granted the board's unlimited approval. A general view of one of the props in the range is shown in Fig. 1.

The new props have a yield load capacity of 25 tons and this higher than normal rating allows for slight variations in prop density where roof conditions permit, and, of course, makes for greater safety. A comprehensive size range is available for seam heights varying from 2 ft. to 7 ft., details being given in Table 1. All sizes are characterized by their speedy and reliable early bearing, a convergence of less than ¼ in. automatically increasing the load capacity from 6 to 25 tons. The characteristic of the yield valve is shown in Fig. 2.

To facilitate quick setting, the "Pathfinder"

TABLE 1.—*Details of the Size Range of "Pathfinder" Props.*

Extended length.	Contracted length.	Travel.	Model No.
In.	In.	In.	
28	22		062802
31	25	6	063105
34	28		063408
37	28		093702
40	31	9	094005
43	34		094308
46	37		094611
49	34		154902
52	37		155205
55	40		1555081
58	43	15	155441
61	46		15681
64	49		15611
67	43		2467072
70	46		24700
73	49	24	247305
76	52		2476118
79	55		247914
82	58		248217

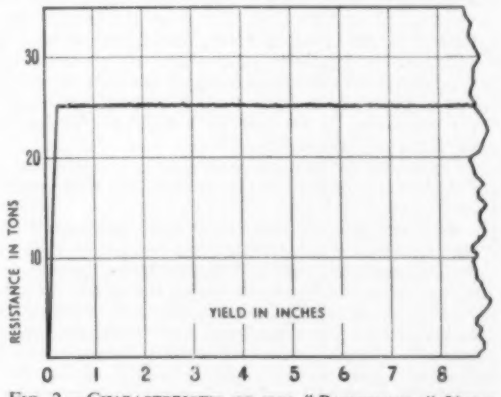


FIG. 2.—CHARACTERISTIC OF THE "PATHFINDER" YIELD VALVE.

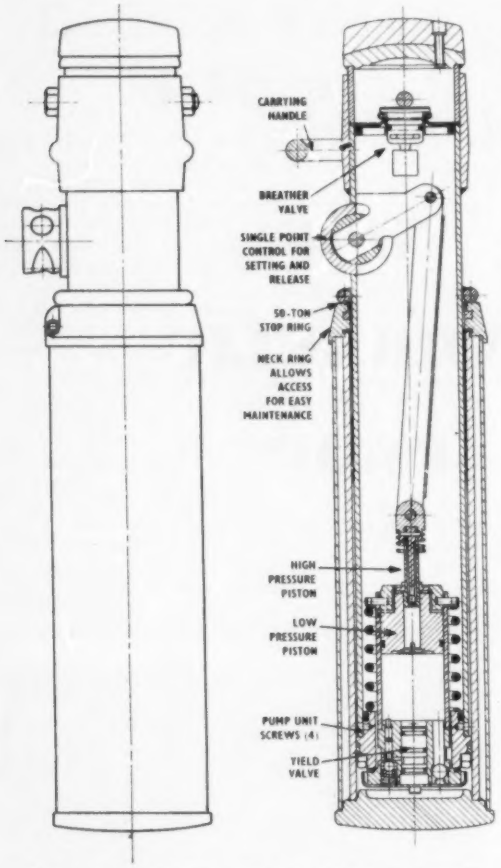


FIG. 3.—WORKING DETAILS OF THE "PATHFINDER" PROP.

props are fitted with a two-stage pump, operated by a crank spindle (Fig. 3). With the handle fitted to the crank spindle, a total radial movement of 90 deg. is possible, and with this travel, four operations are obtained:—(1) Extension at 0.7-in. per stroke; (2) setting at 1 ton load per stroke; (3) unloading by as little as 1 ton for examination of the roof; (4) collapse.

Thus the prop cannot be released accidentally. Props can be preset by the manufacturers to setting loads between 5 and 10 tons.

One of the "Pathfinder's" main features is the way in which maintenance costs have been reduced by a design which permits the valve and pump unit to be easily withdrawn and replaced within 15 min. New replacement sub-assemblies are provided in sealed polythene containers for transport underground. Repair of the replacement components is effected either at the maker's works or in Area workshops; special training is available for colliery personnel in these techniques.

Other features are a special gland ring and guide fitted to the 4-in. dia. pressure-chamber cylinder (honed to less than 20 micro in.). The sliding member completely seals out dirt and water. Special protective coatings for the ram are available to suit all operating conditions.

A hard chrome-plated bore can be supplied at extra cost.

The props are also fitted with a special breather valve which, while letting air in and out as necessary while in the vertical position, completely prevents oil leakage if the prop should be stored in the horizontal position. Finished in a bright yellow paint for maximum visibility underground, the "Pathfinder" offers advantages in maintenance costs, which inevitably result in lower prop cost per ton. The prop has been granted NCB approval No. H18.

EFFECTIVE DUST SUPPRESSION FOR COAL CUTTERS

FOR many years attempts have been made to devise satisfactory means of conducting water from a supply point on a coal cutter through ducts in the cutting jib to the back of the kerf, in order to suppress dust and reduce the ignition hazard. Because of the continued demand for equipment providing these means, the Central Engineering Establishment of the National Coal Board has designed a dust-suppression jib. The development has been effected using Anderson, Boyes machines, but the design can be adapted to equipment supplied by other manufacturers.

Laboratory and operational experience has indicated that the following features must be incorporated in the design of the equipment to achieve satisfactory results:—

(1) In order to minimize dust suppression and the ignition hazard, the cutting faces of picks should be flushed with water when they are cutting.

(2) Water should be mixed as intimately as possible with the kervings as soon as possible after they are formed.

(3) To minimize wastage of water by drainage, water should be applied only to those picks which are cutting.

(4) Water outlets to the jib should be sufficiently large to minimize the tendency to become clogged.

(5) As much of the water-supply system as possible should be accessible to facilitate maintenance.

(6) The various parts of the water-supply system should, as far as possible, be contained within the dimensions of the machine to reduce the liability of damage.

(7) Any additional operations required (owing to the incorporation of dust-suppression features, etc.) which may reduce the versatility of the machine should be minimized.

The equipment, which is described in information bulletin 61/230 of the production department of the National Coal Board, has been developed to incorporate these features as nearly as possible.

Iron-ore Mining in Germany

FORMATION OF AN INTEGRAL MINE

Three hitherto independent iron-ore mines in the Salzgitter district have been combined by a new central shaft, "Fortuna 2," which went into operation in 1960. Approximately 4,000 tons of ore, with an iron content of 28 per cent., is handled daily, which represents about 7 per cent. of the total tonnage of iron ore produced in the Federal Republic of Germany. The factors which were taken into account when planning the central shaft were described in an article, of which extracts are given here, by Reinhard Böhne in Demag News (No. 160).

FORTUNA mines of the Barbara Erzbergbau AG are situated in the southern part of the Salzgitter mountain range between Goslar and Salzgitter. The three mines, the Fortuna, Ida, and Morgenstern, have a total daily output of 4,000 to 5,000 tons of the Salzgitter-type ore containing, on the average, 28 per cent. Fe and 28 per cent. SiO_2. The ore is won from extensive deposits by the room-and-pillar mining method with irregular rooms. In a central dressing plant at the Fortuna mine the ore is prepared for concentration. At present, the three Fortuna mines have a staff of approximately 800 wage-earners and 100 salaried employees.

To ensure economy with costs increasing due to a shorter working week and poorer quality crude ore at greater depth, it was proposed to establish an underground link between the Fortuna mine, the Morgenstern mine situated 2½ miles to the south, and the Anna/Hoffnung lease area located about 1 mile to the north so as to form an integral mine. In this way all surface operations at the Morgenstern mine including shaft winding and aerial ropeway operation from Morgenstern to Fortuna would be dispensed with, the output of the Morgenstern surface installations being limited to 400 ton/shift and costly to operate.

The existing winding shaft at the Fortuna mine was not capable of coping with any further production from the areas to be linked up. Moreover, neither the winders nor the headgear at the Fortuna mine would have been capable of handling the production from the next lower level in that area.

New Central Shaft

All these considerations led to a new central shaft being provided at the Fortuna mine.

The location of this shaft (No. 2) was selected on the basis of its position relative to the central dressing plant. It was to be located only such a distance away from it that the crude ore could be readily passed to the dressing plant via a conveyor bridge after preliminary crushing and intermediate storage.

Geological conditions were also determining factors, because the heavily watered strata of the middle Bunter sandstone made it necessary to adopt a location in the proximity of the upper bed so as to ensure that the shaft would still be far enough away from the water-bearing strata if it was to be sunk to a deeper level at a later stage. Preliminary boreholes confirmed the assumption that at this location the ore deposit was definitely unworkable. Together with the crude ore coming from the Ida mine via the mine junction railway, the compound installation was to supply the dressing plant with 5,500 to 6,000 tons of ore per day. This meant that the No. 2 shaft had to handle an output of 4,000 ton/day. During many years to come 70 per cent. of this tonnage will come from No. 3 level located at a depth of approximately 190 yd., and 30 per cent. from No. 7 level located at a depth of 448 yd.

The good results obtained with the single-compartment skipwinder in No. 1 shaft led to the adoption of a similar winder for winding ore in No. 2 shaft. The skipwinding installation of this shaft was to be designed to handle the total production. The plan dimensions of the skip were to be as large as possible in order to prevent the unbroken material to be handled from clogging. With a cubic capacity of 176 cu. ft. and a pay load of 9 tons, the bottom-discharge skip was given plan dimensions of approximately 5 ft. by 7 ft. Apart from its ability to serve several levels, a single-compartment skipwinder has the considerable advantage of permitting much simpler and less costly filling facilities and making it possible for the width of the skip to be used for loading and unloading.

At a low speed of only 6 m./sec., this single-compartment skipwinding installation is capable of raising 320 ton/hr. from the first level plus 180 ton/hr. from the second level with a driving power of not more than 450 kW.

On the basis of the production hoisted from each of the two levels, an actual winding time of roughly 15 hr. is required to hoist 4,000 ton/day.

In order to utilize the skipwinding plant purely for winding ore, it is intended to incorporate a second winding installation with cage and counterweight in the same shaft. To speed-up man-riding, the cage will have three decks, each for 10 men. Whereas the two lower decks can each take a mine car with a total weight of 3 tons, the upper deck is used for man-riding only. It is, however, almost 10 ft. high, fitted with drop doors and designed to handle bulky material. Since the

cage winder must serve three levels, single-compartment winding is an advantage.

As the skip is of the side-loaded type it is necessary to guide it both at its head and tail ends, which has many advantages. Since the shaft is an upcast, it has partition timbering of oak which has a longer life than steel. Moreover, calculations have proved that steel buntons are not cheaper than timber buntons. Both cage and skip are provided with guide rollers and the small counterweights are provided with simple guide shoes.

The use of a Koepe hoist was a matter of course after single-compartment winding had been decided upon. Small depths and not unusual rope loads of a maximum of 25 tons for the skip, made the adoption of single rope winding highly advisable. A winding rope of about 2 in. dia., galvanized, of Warrington make and Lang's lay construction, with a tensile wire strength of 144 ton/sq. in., was found to be suitable for skip-winding. For the cage winder a rope of 2 in. dia. was also chosen to enable common spares to be carried. Floor-mounted winders, installed side by side in one building, made possible the selection of a single-brace headframe.

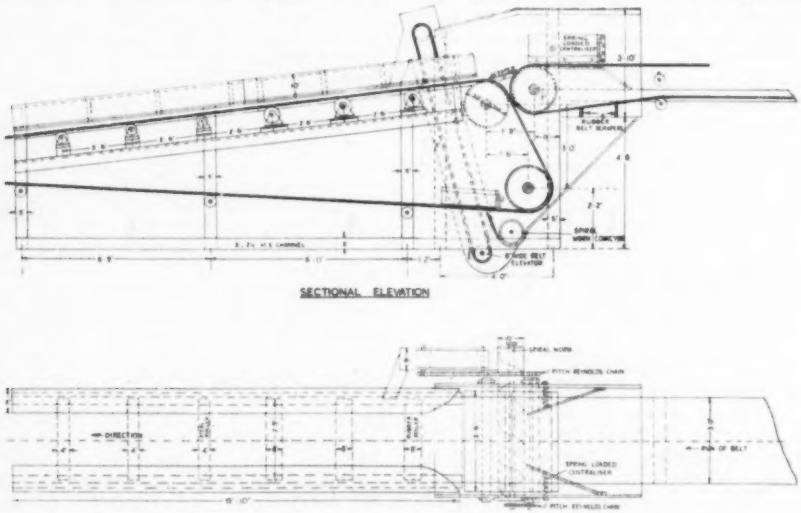
The winders are of identical design to simplify spares requirements. They have a 6-kV three-phase motor drive transmitting through gears power onto the Koepe pulley having a diameter of approximately 15 ft. The four fully identical headgear sheaves have also a rope tread diameter of 15 ft.

To speed up winding and to provide safeguards against faulty operation, the skipwinding installation has been provided with an automatic system. Arrangements are made, however, for the skip banksman to check whether sticky ore lumps have accumulated in the receiving hopper or in the chutes.

When the ore deposits overlying the first level are exhausted and the third level is opened up, the output capacity of the shaft can be maintained at the present level by the winding speed being increased to 10 or 12 m./sec. All that would be required for this is a motor of higher speed and a correspondingly greater output.

Anti-breakage Transfer Point

RESPONSIBLE for the design of an in-line 36-in. belt conveyor transfer point which eliminates degradation of the coal is Mr. W. Barrett, of the National Coal Board's East Midlands Division. The unit, of strong but simple construction, utilizes a standard Sutcliffe tail-end, hopper section and jib. The absence of large chutes and hooding reduces the resistance to ventilation and thus the amount of airborne dust around the transfer point.



SECTIONAL ELEVATION

PLAN

GENERAL ARRANGEMENT OF ANTI-BREAKAGE, SELF-CLEANING, 36-IN. IN-LINE TRANSFER.

Coal from the feeding conveyor is centralized at its delivery by means of lightly sprung centralizers to give a non-spillage flow of coal onto the receiving conveyor over a small hinged plate lightly held up to the jib end roller by weights.

A self-cleaning spiral, chain driven from a sprocket attached to the extended shaft of a tail-end roller and feeding onto a simple belt elevator also chain driven from a roller, is incorporated in the transfer. This refinement is not essential, as the make of fines around the tail end is negligible and can easily be dealt with by the transfer attendant.

The Scrap Markets

EXPORTS LIKELY

Heavy Grade Ban May Be Eased

FURTHER relaxation in the ban on ferrous scrap exports is expected soon. As it seems certain that the upturn in UK steel production will not be seen for some months, the need to conserve the heavy grades of melting scrap is no longer of great consequence. Heavy stocks of this material have accumulated in recent months and scrap merchants are confident that the steelmakers will no longer raise objection to the surpluses being exported for a short period.

Acceptances by UK consumers have deterioriated considerably and their current stocks exceed 1,250,000 tons. Consumption by steelworks and foundries at present is averaging just over 200,000 tons weekly.

Conditions in the European scrap market are similar to those experienced by UK processors and, should more scrap become available for export, the only likely market would be Italy, where expansion in industry generally, is proceeding at a good rate.

Conditions Should Improve

According to delegates from the British scrap industry, who attended the recent autumn congress of the Iron and Steel Section of the Bureau International de la Recuperation in Amsterdam, continental merchants do not see the current recession being prolonged, and opinion is that by the spring conditions will be vastly improved.

British merchants would welcome the freedom to export all grades of ferrous scrap because, although the European market does not offer great prospects immediately, good outlets are available in the Far East, Japan in particular being a heavy purchaser. Together with the Italian and some Scandinavian markets, the heavy stocks now being carried by merchant traders in the UK could be considerably reduced without inconvenience to domestic consumers.

Cleveland—Shipments of steel turnings have left Tees for Italy following earlier cargoes of about 3,000 tons of turnings to the same destination, and 1,000 bundles to Japan. This trade is being conducted by one or two of the larger firms of scrap merchants, as a result of the recent easing of export controls on these lower grades.

The home market for steelmaking scrap has taken on an even flatter look as works buyers reduce still more the tonnages being accepted.

Scotland—In Glasgow and the West of Scotland the scrap market has recently been a little quieter, due in the main to severe weather conditions which have hampered the handling and loading of scrap material, and slowed down transport. The steelworks continue to work their quota system of deliveries, and there does not seem to be any likelihood of a change in this position in the near future.

The output of steel turnings is at about its usual level, and it is becoming increasingly difficult to dispose of this grade of scrap as the consuming works are becoming more and more particular about the type of material they are prepared to accept. Cast-iron borings continue to be produced at a fairly steady rate but there is no difficulty in disposing of this grade of scrap to the blast furnaces. Cast-iron foundries are still looking for supplies of all grades of cast-iron scrap, and as these are not over-plentiful at the present time there is keen competition to obtain any parcels that do come on the market.

South Wales—Merchants yards are holding considerable stocks of scrap, but there is practically no demand for supplies of any grade. Labels are not being issued, and steelmakers and ironfounders are continuing their policy of bringing down stocks of scrap which they hold themselves before accepting deliveries from outside sources.

With internal arisings, and with the slow output there seems little chance that merchants are going to have any call for the stocks which they have on hand.

Ore Chartering

MARKETS are extremely quiet and with a very poor demand from North America, charterers have been able to fix at under last rates paid and this position may continue. North Spain reports the fixture of Bilbao/Rotterdam-Dordrecht at 17s. for about 1,750 tons for middle-December, but the North Spanish market is generally quiet. This position also applies to West Africa, although Luanda/Emden paid 35s. 6d. for about 11,000 tons for January/February and from Brazil, two vessels have been fixed from Rio/Rotterdam-Weser; 14,500 tons for January 5/20 at 40s. and 11,000 tons for second-half December at 1s. less, both gross terms and Vitoria/Poland 47s. for 12,000 tons, December/January.

Marmagoa/Japan reports 9,500 tons for March at 47s. 6d. f.i.o. and trimmed, and 10,000 tons to West Italian ports, option Trieste at 36s. f.i.o. and trimmed for February 1/20. Two cargoes of pig-iron have been arranged from Durban/Japan both about 13,500 tons, at 60s. one port for February 1/28 and January 4/31, f.i.o. stowed basis.

In the pyrites section, Huelva/Antwerp fixed 6,700 tons for prompt loading at 25s. 3d. and Morphou Bay/Dunkirk—second half January at 32s. 6d. for 9,500 tons. Phosphate from Casablanca/Immingham reported 29s. for 10,000 tons, middle-December; 9,500 tons Casablanca/Holland 19s. 6d. for January/February and Saffi/Holland 9,500 tons December at 20s. 6d.

Coalfield News

Big Saturday Output by West Midlands Miners

LAST of the four voluntary Saturday shifts undertaken before Christmas by miners in the West Midlands Divisional Coal Board, produced the highest output—14,430 tons. The turnout of 6,274 men was also the biggest. Area outputs were:—North Staffordshire, 2,797 tons (from seven collieries); Cannock Chase, 6,775 tons (nine); South Staffordshire and Shropshire, 1,284 tons (four); Warwickshire, 3,576 tons (six).

In the week ended December 9, three collieries set overall OMS records. They were:—Florence (North Staffs), 45 cwt.; West Cannock No. 5, 47.6 cwt., and Hamstead (South Staffs), 35 cwt. Hamstead Colliery broke its saleable output record for the third week running with 6,016 tons and Granville Colliery (Salop) beat a year-old record with 5,714 tons.

Mr. THOMAS JOHNSON (45), haulage hand at Orgreave Colliery, Handsworth (Yorks), has won £32,640 in the football pools.

MORE THAN 600 sick or injured Durham miners were visited in hospital last week by senior Division and Area officials of the Durham Division of the NCB, who distributed a Christmas gift parcel, together with wishes for a speedy recovery, to each man.

OVERALL PRODUCTIVITY in the Durham Division of the NCB in the first 49 weeks of the year reached 23.15 cwt. per manshift, compared with 22.23 cwt. in the same period of last year. At the face, productivity reached 66.02 (64.63 cwt.) per manshift.

SHIPMENTS of coal and coke to home and foreign destinations from the South Wales ports in the week ended December 16 reached 64,385 tons, an improvement of 12,718 tons on the previous week and of 5,029 tons over the corresponding week last year.

IN BULL WEEK before Christmas miners in the East Midlands Division of the NCB broke a three-year-old record and for the first time produced 1,000,000 tons of saleable coal in a five-day week. Previous record weekly output of 984,300 tons was set up in December, 1958.

RED SHALE from the colliery spoil heaps around Stoke-on-Trent may be used for the construction of roads and the filling-in of low-lying areas in Staffordshire. Both the Ministry of Housing and Local Government and the Ministry of Transport have agreed in principle to the scheme.

COAL AND COKE shipments from the Hartlepools during the 48 weeks ended December 4 amounted to 1,395,342 tons, compared with 1,223,921 tons in the same period a year ago. This year's figures include exports of 15,529 tons, against 40,055 tons last year. Imports of iron ore were 609,686 (713,779) tons.

CLOSURE of Rothes Colliery (Fife), could be prevented if the National Coal Board were willing to spend up to £2,000,000 on further stone mine drivage, Mr. John McArthur, Fife district secretary of the National Union of Mineworkers, maintained at a public meeting at Lochgelly called to consider pit closures.

WITH SOME SEAMS completely worked out, single-shifting at the 100-year-old Parkhouse Colliery, near Chesterfield (Derbyshire), is likely from January 15, says the East Midlands Divisional Coal Board. There will be no redundancy it is emphasized and the 138 men affected by the worked out seams will be offered jobs at other pits.

Coal Price Increases : NABM Protest

DIRECTOR of the National Association of British Manufacturers, Mr. H. J. Gray has protested to Lord Robens, chairman of the National Coal Board, regarding his proposals to increase the prices of some industrial coals from next Monday, saying that the increases would add to industry's difficulties in seeking to keep selling prices steady, and would adversely affect its efforts to meet foreign competition, both at home and abroad.

In a statement on Wednesday of last week, Mr. Gray asked why industry alone and not consumers as a whole, should be called upon to bear the extra charge, and why Scottish and North-Western Division coals should be selected for special treatment.

It was appreciated that certain pits were less economical than others, but it seemed unfair that users who for geographical reasons draw their supplies from particular areas, should be penalized. The statement adds that the increases are likely, in any event, to defeat their own object.

The Coal Board has proposed that prices of industrial coal in the Scottish Division should be increased by about 10s. a ton, coal in the North-Western Division by 6s. a ton, and all large coals in all areas by 10s a ton.

New Power Plants for Durham?

PLANNERS were considering the possibility of a new power station, or two small ones, in the Durham area, said Lord Robens, speaking in Durham recently. The Central Electricity Generating Board had stated that a new power plant might be needed in the area in 10 years, but, Lord Robens said, the Coal Board had pointed out that in that time conditions might be different and the coal and manpower might not be available, and the scheme should be considered now.

Durham's coking coal was no longer needed to the same extent as formerly, he added, and scientists were working to find new ways of using it, which included the injection of milled coal into blast furnaces, instead of oil, and the total gasification of coal in the Lurgi process. There was a wide opportunity on these two fronts and the third was in power generation.

The suggested power stations in Durham may include two small plants each using 2,500,000 tons of coal annually, or one large plant requiring 5,000,000 tons. The future of the Durham coalfield lay in new and reconstructed pits on the east coast and in the south of the county, Lord Robens felt.

Christmas Message Warns South Wales Miners

SUCCESSFUL future of the mining industry depended on the National Coal Board sticking to its policy of closing old, inefficient pits and transferring the men to more productive projects, said Mr. A. H. Kellett, chairman of the South-Western Division of the NCB, in his Christmas message to the South Wales coalfield.

Higher productivity obtained in this way would reflect itself in increased output, reduced costs, and improved financial results from the Division, giving greater security and improved rewards for those in the industry, he said.

THE COAL TRADE

HOLIDAYS and the weather led to an exceptionally busy period for merchants just before Christmas and, in spite of this pressure on labour and transport, few customers were disappointed. It was certainly an ill wind that brought the power cuts on Christmas Day—a wind that will blow the trade no harm providing it can maintain a high standard of service to the customer. The New Year will usher in an expanding and a changing market. It will not be without its problems but the prospects are brighter than they have been for several years.

LEICESTERSHIRE

The expected upsurge of orders before Christmas led to distributors' offices being inundated with requests for immediate supplies. As usual, the bad road conditions affected road-borne supplies and depots generally have not received quite so much tonnage as in previous weeks. This has meant some lifting from stock, and fleets generally have been working long hours to cope with the situation. Supplies of special grades have been difficult and there is no improvement in supplies of those grades of anthracite which have been scarce for so long. Coalite and Rexco also show no improvement, and most distributors are now awaiting supplies. Cleanglow and Gloco, on the other hand, being in good supply, are taking the main weight for this type of trade. The tonnage continues to grow week by week and a steady trade is being built up by retailers generally for these fuels. There are small tonnages of coals now being offered outside contract. Some of these are outside the normal quality groups, but are useful for trolley trade which at present is heavy.

The central heating market remains firm and good tonnages have been delivered during a great influx of orders, but these generally slowed down before Christmas.

The industrial coal market remains firm and apart from hold-ups due to bad road conditions and some congestion at local producing units, deliveries have been good and industry is well supplied locally.

Drive to Start "Safety Era" in Collieries

OBJECT of the mining industry's National Safety Year was not to make 1962 specifically a safety year, but the introduction of a safety era, said Mr. John Brass, chairman of the West Midlands Divisional Coal Board, speaking at Dudley (Worcs), last week, on the Division's campaign.

Dr. J. Smillie, production director, explained that apart from averting family hardship and distress, a reasonable reduction in the divisional accident rate would mean that 50,000 more tons of coal, worth £250,000, would be produced.

NCB Landsale Depot Charges

CHARGES payable for lorry loading facilities at National Coal Board landsale depots are to be increased in the North-Eastern and East Midlands divisions.

As circumstances differ at loading points, the increases will vary.

LABOUR FORCE of 1,300 men at Hylton Colliery (Co. Durham) is to be reduced by 100 because production of low volatile coal is to cease. The men will be absorbed at neighbouring collieries.

Coal Chartering

IN common with other markets, the coal market for Hampton Roads is quiet and only a few fixtures have been reported. From an owners' point of view, rates are certainly easier and much will depend on an improvement in the demand as to whether the undertone will show signs of steadying. Hampton Roads/Japan reports $9.50 for January 5/25 for about 13,000 tons and 11,500 tons for January/February was secured at $9.00. February—26,000-tonner, basis six days Shinc, was fixed also to Japan at $8.05. There appears to be no hurry on the part of charterers to fix forward.

As far as the Continent is concerned, it is reported that Hampton Roads/Holland secured a 20,000-tonner for January at 24s. with 3,000 tons free discharge, whereas a 15,000-tonner secured 27s. 9d. to Rotterdam or Amsterdam with the option of German ports at 29s. 3d. for January/February. Hampton Roads/Rio is reported to have paid $6.40 for 9,800 tons, January 10/25, but this market is weaker and here again the forward position is quiet and charterers only appear to be interested at even lower rates. Hampton Roads/West Italy paid $4.00 for 17,000 tons, December 20/January.

While there is some demand from the Continent to Mediterranean destinations, the market is not active and Poland/Alexandria paid 45s., 8,000 tons basis coal and coke for December 13/20 and Nordenham/Piraeus 32s. 6d. for 14,000 tons, December. Outward chartering from UK ports is still very slow to develop but Immingham/Matanzas reported $6.00 f.i.o. and trimmed for about 6,100 tons of coke, second-half December.

"BULL" WEEK IN DURHAM COALFIELD

IN "bull" week, which ended on December 16, miners in the Durham Division of the NCB raised 478,600 tons of saleable coal. While this was only 1,700 tons below the level for the corresponding week of 1960, the labour force has decreased by about 3,600 to 83,000. In terms of productivity, however, saleable output per manshift in the period increased by just over 1 cwt. to almost 24.24 cwt. As a result of increased efforts, Durham miners shared a £1,200,000 wage packet, about £40,000 more than a normal week.

One of the record breaking collieries was Washington "F" where the week's raised and weighed output of 12,379 tons was the highest in its history. The total included 5,400 tons off a mechanized face, one of the best performances at the pit.

Company News

Fairbairn Lawson Capital Reorganization

IF the proposed scheme of capital reorganization of Fairbairn Lawson Combe Barbour, Limited, manufacturers of textile machinery, machine tools, etc., of Leeds, is approved, it will mean that as from March 16, 1962, for every five first preference £1 shares, holders will have six 7 per cent. convertible cumulative preference £1 shares and six ordinary 1s. shares. For every 80 preferred ordinary 1s. share, the exchange is 50 7 per cent. convertible cumulative preference £1 shares and 48 ordinary 1s. shares.

In return for allowing the non-cumulative preference shares. For every 80 preferred ordinary 1s. share, the receive a free issue of ordinary equivalent to 6 per cent. of their holdings. Each 7 per cent. convertible cumulative preference will carry the right at any time until March 31, 1966, to convert into 20 ordinary shares.

S. RUSSELL & SONS, LIMITED, mechanical and structural engineers, etc., of Leicester—Interim dividend has been declared at 5 per cent. on the capital as increased by the one-for-four bonus issue, which is equivalent to the 4 per cent. paid last year.

TAP & DIE CORPORATION, LIMITED—Contracts have been exchanged for the purchase of the machine-tools division of Smart & Brown (Machine Tools), Limited, Biggleswade (Beds), for £300,000, to be satisfied by the issue of 300,000 ordinary 5s. shares and £42,884 cash.

HUNSLET (HOLDINGS), LIMITED—Group profit, excluding the newly-acquired subsidiary, Materials Handling Equipment (Great Britain), Limited, fell to £12,443 (£33,668), before tax of £8,500 (£15,400), and dividend for the year to July 31, 1961, is being halved to 3¼ per cent.

METAL TRADERS, LIMITED, London, E.C.3—The report and accounts for the year to March 31, 1961, and the payment of a dividend of 6d. per 2s. unit of stock less income tax, were adopted at the annual meeting last week. The retiring director, Mr. W. O. Stern, was re-elected.

UNITED SPRING COMPANY, LIMITED—Net profit is £45,786 (£73,258) after tax of £39,551 (£65,990) and a 6 per cent. dividend is being paid for the year ended September 30, 1961. A dividend of 12½ per cent. from profits of not less than £100,000 has been indicated for 1961-62.

PRIESTMAN BROS., LIMITED, makers of excavators, dredging cranes, etc., of Hull—Group net profit for the year ended September 30, 1961, amounted to £174,466 (£149,146), after tax of £156,000 (£141,000). A final dividend of 6 per cent. on the £1,000,000 ordinary is recommended.

W. H. ALLEN, SONS & COMPANY, LIMITED, mechanical, hydraulic, and electrical engineers, of Bedford—Declaring a maintained interim dividend of 2½ per cent., the board states that the profit for 1961 will be lower than that foreseen at the July annual meeting. The order-book position has improved, but the decline in profit margin has been accentuated.

J. & J. DYSON, LIMITED, manufacturers of firebricks, and refractory materials, of Sheffield—The company is making an offer for the £400,000 capital of Ceramic (Holdings), Limited. The offer will be 15 "A" ordinary 5s. shares in Dyson for every 16 ordinary 10s. shares in Ceramic, or, alternatively, nine "A" ordinary shares and 80s. cash for every 16 ordinary in Ceramic. As other companies have intimated their intention to make offers, it may be some time before the directors of Ceramic can advise holders as to what action they should take, it is stated.

REDPATH, BROWN & COMPANY, LIMITED, structural engineers, and iron and steel stockholders, of Edinburgh—Net profit for the year to September 30, 1961, was £309,632 (£302,806) after tax of £293,606 (£242,719). The order-book has recently been strengthened by a substantial new power station contract, but inquiry, at home and oversea, continues to fall.

J. H. FENNER & COMPANY (OVERSEAS), LIMITED—A new marketing company, located in Ansbach, in which J. H. Fenner holds a major interest, has been formed in Germany and will be known as Fenner & Hochreuter, GmbH. Fenner has been associated for some time with Hochreuter & Baum, of Ansbach, and through it has increased the distribution of Fenner V-belt drives, etc., in Germany.

TURNER & NEWALL, LIMITED—Group trading profit increased from £13,636,555 to £14,778,690 in the year to September 30, 1961. After taxation of £8,322,223 (£7,171,434) there is a net profit of £7,734,238 (£7,624,706). The final dividend is 8 per cent., making 12 per cent. on the increased ordinary capital. A total equal to 12 per cent., adjusting for a scrip issue between interim and final, was paid for 1959-60.

BROOM & WADE, LIMITED, manufacturers of air compressors, rock drills, etc., of High Wycombe (Bucks)—Group profits for the year to September 30, 1961, were lower at £971,637 (£1,044,922), but, despite the fall, the final dividend of 17½ per cent. will make a total of 22½ per cent. The chairman, Mr. H. S. "Dick" Broom, says that the order-book at the start of the company's year is less than that of a year ago, but is still very satisfactory.

LODGE PLUGS, LIMITED, spark plugs and boiler ignition equipment makers, of Rugby—Firm offer of 19s. cash per Lodge share has been made by S. Smith & Sons (England), Limited. The directors consider the offer "fair and reasonable" and intend to accept in respect of their own holdings. At 19s. the offer is worth £950,000. Smiths has stated it is interested in the merger possibilities of Lodge Plugs and its subsidiary, K.L.G. Sparking Plugs, Limited.

COPE, ALLMAN & COMPANY, LIMITED, manufacturers of brass, copper, and cased tubes of Birmingham—The company has acquired the capital of Wade Smith & Company, Limited, engineers, and manufacturers of wire cloth, of Wolverhampton, for £185,500, by the issue of 114,000 Cope, Allman 5s. "A" ordinary shares. Cope, Allman has also acquired, for cash, a controlling interest in Metal Art (Proprietary), Limited, engineers and manufacturers of buttons and badges, and three wholly-owned subsidiaries, all of Pretoria, South Africa.

JOSEPH RHODES & SONS, LIMITED, sheet metal working machinery manufacturers, of Wakefield (Yorks)—Entire equity capital of the company has been purchased for about £1,000,000 cash by Lindustries, Limited, which states that it plans to expand established products. Mr. W. S. Rhodes will remain chairman of the company and he and Mr. H. Ridgway will continue to be joint managing directors. Three members of the Lindustries board, Mr. W. E. Luke (chairman), Mr. Walter Miller (financial director), and Mr. B. Boxall (deputy chairman of the engineering division), will join the Rhodes board.

QUALCAST, LIMITED, light repetition steel and iron-founders, and lawn mower manufacturers, of Derby—In connection with last month's merger discussions, the company has made a share exchange offer of 11 ordinary Qualcast 5s. shares for every 10 shares of 5s.

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(£250,000 is issue) in Charles H. Pugh, Limited, manufacturers of motor lawn mowers, of Birmingham. The directors of Charles H. Pugh intend to recommend acceptance and to accept in respect of their own holdings. Shareholders of Charles H. Pugh will be entitled to retain the final dividend of 9 per cent. and the special distribution of 3½ per cent., free of tax, recommended in respect of the year to July 31, 1961.

TECALEMIT, LIMITED, lubrication, hydraulic, and filtration engineers, of Brentford (Middx)—Despite somewhat lower results for the first quarter of the current year, the future can be viewed with restrained optimism, subject to forces beyond board control, reports the chairman, Mr. S. G. Gates. The parent company was responsible for 71 per cent., £344,839 (£298,359), of the group profit, although its turnover rose by only 6½ per cent. The chairman points out that the policy of broadening the base of the group's business is taking effect, as no more than four years ago the parent's profits were nearly 85 per cent. of the group's total.

Orders Placed

SIX GAS TURBINES worth £125,000 are to be built by Ruston & Hornsby, Limited, to the order of the Kuwait Government, to provide power for pumping water from Rawdatain to Kuwait.

AIR PRE-HEATERS for the new power station at Eggborough (Yorks) are to be built by Davidson & Company, Limited, Belfast. The order, worth £1,250,000, is the largest single contract secured by the company.

WORTH £285,000, a contract has been secured by British Northrop Sales, Limited, Blackburn (Lancs), to supply automatic looms and accessories for the Société de Filature et Tissage de Homs, Homs, Syria.

ORDER FOR 500 control panels, valued at £40,000, has been placed with Brookhirst Igranic, Limited, a company in the Metal Industries group, by British Insulated Callender's Cables, Limited. Half the panels are for use with capacitors up to 100 kVAr and the rest for use with capacitors up to 65 kVAr.

CONTRACT WORTH £1,300,000 has been awarded to the Coppee Company (Great Britain), Limited, by Hindustan Steel Company, Limited, for extension of the coal preparation plant being built at Bhojudih, Bihar, India. Construction is being carried out by Coppee under a contract placed about 18 months ago, and the new order brings the total value to over £2,500,000.

Giant Dragline for Italy to be Equipped by AEI

ELECTRICAL equipment valued at £130,000 has been ordered from Associated Electrical Industries, Limited (motor and control gear division), by Ransomes & Rapier, Limited, for a giant walking dragline which it is supplying to Italy.

The order placed with AEI includes two Ward-Leonard motor-generator sets, which will supply 12 340 h.p. motors for driving the hoist, drag, walk, and swing motions of the excavator, as well as two smaller auxiliary motor-generator sets, amplidynes, and contactor control gear.

European Coal Output

THE appended figures relating to coal output and imports are taken from statistics issued from Geneva by the Coal Committee of the Economic Commission for Europe.

Tonnages are metric, and the number of underground workers employed relates approximately to the end of the month.

TABLE 1.—*European Coal Output (Metric Tons) and Employment.*

Country.	Output.		Underground employment.	
	September, 1961.	August, 1961.	Sept., 1961.	August, 1961.
Belgium	1,807,000	1,770,000	68,000	69,000
France	4,146,000	3,827,000	119,000	119,000
Italy	70,000	73,000	—	—
Netherlands	983,000	973,000	27,000	27,000
Poland	8,905,000	9,244,000	211,000	211,000
United Kingdom	18,836,000	11,104,000	448,000	450,000
Spain	1,128,000	1,175,000	—	—
Western Germany	11,171,000	11,874,000	282,000	284,000

TABLE 2.—*European Solid Fuel Imports in September, 1961, with Figures for August, 1961, shown in Brackets (Metric Tons).*

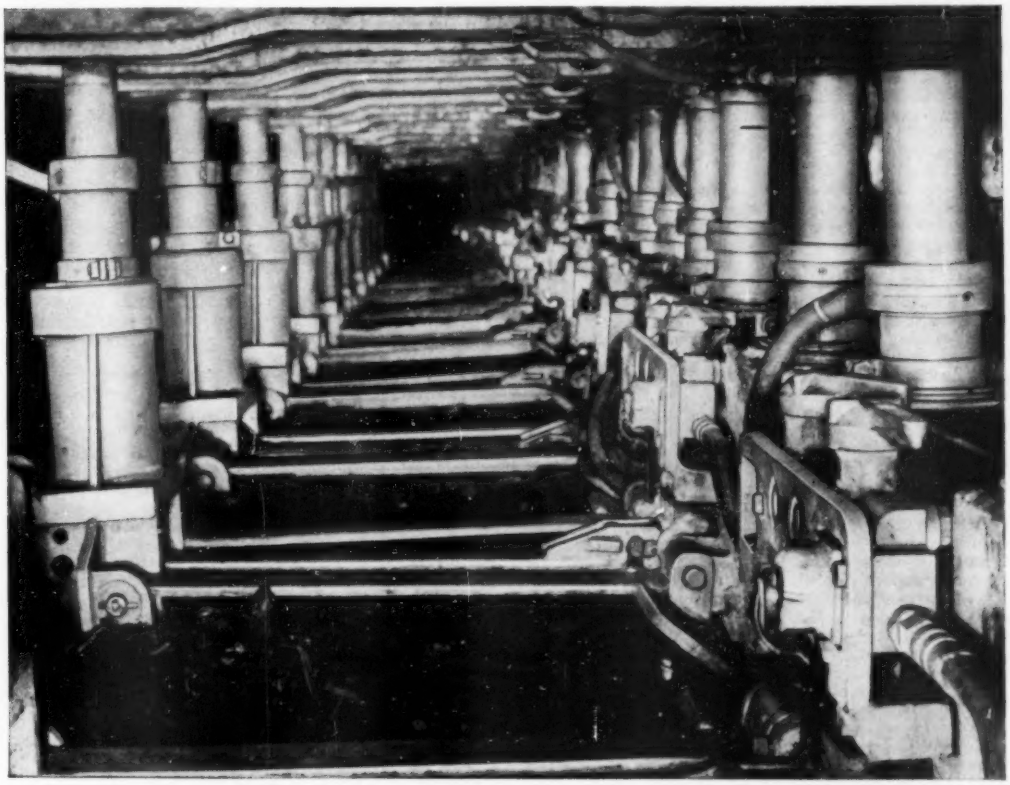
Importing country.	Coal and patent fuel.	Coke.	Lignite and brown coal briquettes.
Austria	272,000 (277,000)	75,000 (57,000)	71,000 (64,000)
Belgium	338,000 (350,000)	22,000 (21,000)	8,000 (8,000)
Denmark	387,000 (306,000)	97,000 (123,000)	26,000 (16,000)
Finland	255,000* (251,000)	15,000* (11,000)	(—)
France	904,000 (772,000)	483,000 (402,000)	40,000 (40,000)
Greece	15,000* (12,000)*	1,000* (1,000)*	(—)
Eire	108,000* (107,000)*	— (1,000)*	(—)
Italy	797,000 (862,000)	27,000 (10,000)	20,000 (22,000)
Luxembourg	16,000 (18,000)	343,000 (349,000)	11,000 (11,000)
Netherlands	548,000* (569,000)	23,000* (17,000)	38,000* (41,000)
Norway	47,000* (37,000)*	38,000* (23,000)*	(—)
Portugal	38,000 (30,000)	12,000 (16,000)	(—)
Sweden	179,000 (180,000)	194,000 (232,000)	1,000 (1,000)
Switzerland	172,000 (154,000)	41,000 (60,000)	19,000 (19,000)
United Kingdom	(—)	(—)	(—)
Western Germany	620,000 (713,000)	24,000 (29,000)	405,000 (394,000)

* Secretariat estimate.

LINTON COLLIERY SETS UK OUTPUT RECORD

MINERS in the Five-quarter Seam at Linton Colliery, near Ashington (Northumberland), recently established what is claimed to be a British, and possibly a European, record with a face output of 22.84 tons per manshift. The previous record for power-loaded coal faces in the 3-ft. range was 22.53 tons set by Barrow Colliery (Yorks), where 8,000 tons were produced from one coal face during a week.

This figure was almost beaten recently by 75 men in the No. 7 Seam of Dodworth Colliery (Yorks), who produced 7,900 tons.



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NEWS IN BRIEF

EMPLOYEES of Bairds & Scottish Steel, Limited, Glasgow, gave £1,155 to charitable institutions during 1961.

THE BOARDS OF W. Tyzack Sons & Turner, Limited, and W. A. Tyzack & Company, Limited, have agreed to discuss the possibility of a merger, which would reunite the two concerns, separated 93 years ago.

STEEL OUTPUT in Italy during the first 11 months of this year amounted to 8,300,000 tons. This is 11.2 per cent. more than in the same period of last year. Pig-iron output went up by 14 per cent. to 2,700,000 tons.

AS PART OF a programme for the expansion of manufacturing facilities, additional factories are being acquired in the special areas in the north of England and Scotland by the Elliott-Automation, Limited, group.

NEW DEPOT has been opened on the Stretford Road, Trafford Bar, Manchester, by Abelson & Company (Engineers), Limited, engineers and machinery merchants, of Birmingham. It will be under the direction of Mr. H. B. Higginbottom.

LONDON headquarters of Associated Portland Cement Manufacturers, Limited, is to be transferred from the present offices at Tothill Street, W.1, to a 28-storey office block at Victoria, which will become the new Portland House.

A NEW OVERSEA marketing agreement has been signed by William Boby & Company, Limited, Hertfordshire water treatment engineers, with a company in Calcutta. Under its terms, Bird & Company (Private), Limited, will sell electrodialytic equipment throughout India.

BECAUSE OF slack trading conditions, the Consett Iron Company, Limited (Co. Durham), is to issue redundancy notices shortly to between 120 and 150 employees, some of whom are long-service employees. Several months ago, 450 men were discharged by the firm, but about 60 were later recalled.

SHORT-TIME WORKING in the steel industry and possible large-scale redundancy in the shipyards are to be discussed at a conference to be held by the General Council of the Scottish TUC in the New Year. The council said that in addition to the rail cuts and pit closures, the "serious situation" in the steel industry was giving cause for concern.

AS PART of a drive to expand oversea markets, Firth Cleveland, Limited, has formed Firth Cleveland (Australasia), Limited. The two existing Australian companies, Firth Cleveland Pty., Limited, and Stenor Industries Pty., Limited, will be subsidiaries of Firth Cleveland (Australasia), which will co-ordinate and control marketing of the group's products.

A FACTORY IN which it is hoped annually to produce 3,000 tons of steel wire ropes, is to be set up in the Southern Indian State of Kerala by Seshasayee Wire Ropes, Limited, a recently-formed company with an authorized capital of Rs 10,000,000 (£750,000). The company has secured the technical and financial collaboration of two Japanese firms, Kokoku Kosensaku, and Ataka.

FIVE YOUNG EMPLOYEES of the Stanton Ironworks Company, Limited, near Nottingham, a member of the Stewarts and Lloyds, Limited, group, received Gold Standard Awards from the Duke of Edinburgh at St. James's Palace last week. Twenty-eight of the firm's employees have now achieved Gold Awards, the highest standard which can be attained in the Duke's award scheme.

APPROVAL HAS been given by the Secretary of State for Scotland for the construction of a £50,000,000 generating station at Cockenzie, East Lothian, for the South of Scotland Electricity Board. It will be the largest coal-fired generating station in Scotland, using about 10,000 tons of coal daily from the Lothians coalfield. The station will have an installed capacity of 1,200,000 kW.

AGREEMENT HAS been reached between the Prestcold division of the Pressed Steel Company, Limited, Cowley, Oxford, and the domestic appliance division of the English Electric Company, Limited, to make certain appliances and components for each other "on a reciprocal basis." Each organization will retain its brand identities and will continue to market its products individually.

LOAN equivalent to $19,500,000 has been made by the World Bank to the Indian Iron & Steel Company, Limited. It will assist in financing the company's programme for increasing coal production from 260,000 to 2,200,000 tons a year through the opening up of new mines and the expansion of present ones, and for transporting coal by aerial ropeways to the company's steelworks at Burnpur.

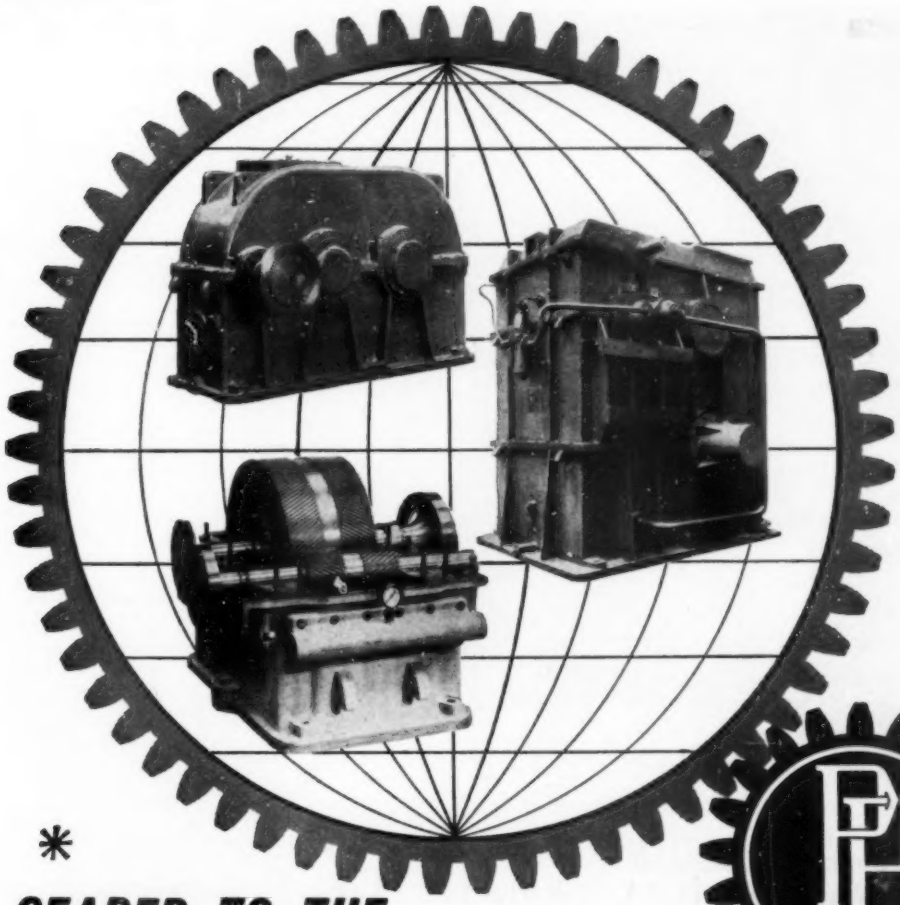
TOP AWARD for an employee's suggestion made by Steel, Peech & Tozer, branch of the United Steel Companies, Limited, has gone to foreman electrician, Mr. K. Eastburn. Mr. Eastburn's modification to the electrical control of the down coilers in the strip mill has earned him £100. During the past year over £1,400 has been awarded for employees' suggestions—about £300 more than in 1960.

PROPOSALS for preventing the closure of the Pontardulais (Glam) works of Glynhir Tinplate Works, Limited, have been made by two Welsh MPs, Mr. Ifor Davies and Mr. James Griffiths, to Mr. W. L. Tregonning, chairman of Bynea Steel Works, Limited, of which Glynhir is a subsidiary. The chairman has undertaken to consider the proposals, which are believed to involve an approach to the Board of Trade for help.

FOLLOWING negotiations with the Metal and Plastic Coating Association, the Association of Metal Sprayers, and other interested organizations the Institute of Welding has established a metal spraying and plastic coating division. A provisional committee is organizing a one-day symposium in association with the spring meeting of the Institute next May, and is also preparing an examination syllabus for specialists in metal spraying.

A PARTY OF FIVE Yugoslav industrial and economic administrators recently visited the Stratford (London) works of Sanders & Forster, Limited, the standard steel building and structural company of the Chamberlain Group where they inspected the recently introduced shotblasting installation for the protection and preservation of structural material, and the company's transfer plant, one of the first of its kind to be installed in the country for the semi-automatic fabrication of structural material.

APPRENTICE at Hall & Pickles, Limited, steel and tool manufacturers, of Sheffield, 20-year-old Lynn Bradbury is to spend a fortnight with a leading European precision engineering plant as a result of winning first prize in a national craftsmanship competition held by the National Gauge and Toolmakers' Association. He received his award diploma recently from Lord Chandos, chairman of Associated Electrical Industries, Limited.



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Exports of British Coal

DETAILS of British coal exports and bunker coal shipments in November, and the totals for the first 11 months of this year and last, are given below.

Categories	Month ended Nov. 30.	Eleven months ended November 30.	
	1961.	1960.	1961.
	Tons.	Tons.	Tons.
Anthracite—			
Large	8,668	75,057	66,377
Graded	22,189	255,850	226,988
Cleaned smalls	49,453	188,967	324,589
All other	35,891	306,028	368,434
Steam coal (including household)—			
Large	20,248	525,935	436,803
Graded	22,767	395,847	255,671
Cleaned smalls	65,026	1,157,582	1,290,483
Untreated smalls	103,921	964,510	1,279,550
Other	23,190	168,741	198,293
Gas coal—			
Unscreened	11,418	180,882	104,929
Graded	32,760	352,271	351,201
All other	1,404	41,841	29,758
Coking coals	24,006	154,515	175,107
TOTAL	420,941	4,768,026	5,108,183
Destinations.			
Canada	—	61,399	50,374
Other Commonwealth countries	1,468	30,152	9,643
Eire	43,727	1,024,305	986,005
Finland	10,710	77,065	64,374
Sweden	20,701	211,311	180,098
Norway	2,448	112,908	110,665
Denmark	85,031	1,421,843	1,190,689
Western Germany	53,401	379,915	488,149
Netherlands	102,310	836,984	1,114,109
Belgium	29,193	189,705	253,732
France	39,025	155,340	386,548
Portugal	7,874	114,902	131,663
Italy	20,004	116,235	106,755
Other foreign countries	5,049	35,962	35,379
Fuel taken on board vessels engaged in the foreign trade (including fishing vessels) for their own use—			
British flag	5,428	263,210	74,916
Other flags	2,869	36,269	28,837

Exports of Coke and Patent Fuel

THE following table gives figures of exports of coke and manufactured fuels from the United Kingdom during November and the totals for the first 11 months of this year and last.

	Month ended Nov. 30.	Eleven months ended November 30.	
	1961.	1960.	1961.
	Tons.	Tons.	Tons.
Gas coke	53,059	611,387	589,248
Hard coke	44,037	453,356	460,113
Breeze	28,796	376,256	334,700
Manufactured fuel	5,679	89,695	54,694
Total	131,571	1,530,694	1,438,755

COAL PRODUCTION in the West Fife Area of the Scottish Divisional Coal Board, in the week ended December 16 reached an all-time record of 58,354 tons. Output per manshift was 29½ cwt., 2½ cwt. higher than the previous week and well above the Scottish average of 24 cwt. and the national average of 28.8 cwt.

Imports and Exports of Mining Machinery

ACCORDING to Board of Trade returns, mining machinery (other than portable power tools) valued at £90,425 was imported during November, compared with £87,088 in November, 1960. Imports for the first 11 months of the year were valued at £1,680,511, against £1,013,842 in the corresponding period of 1960.

The appended table contains figures of export values of mining and well-drilling machinery in November and values for the first 11 months of this year and last.

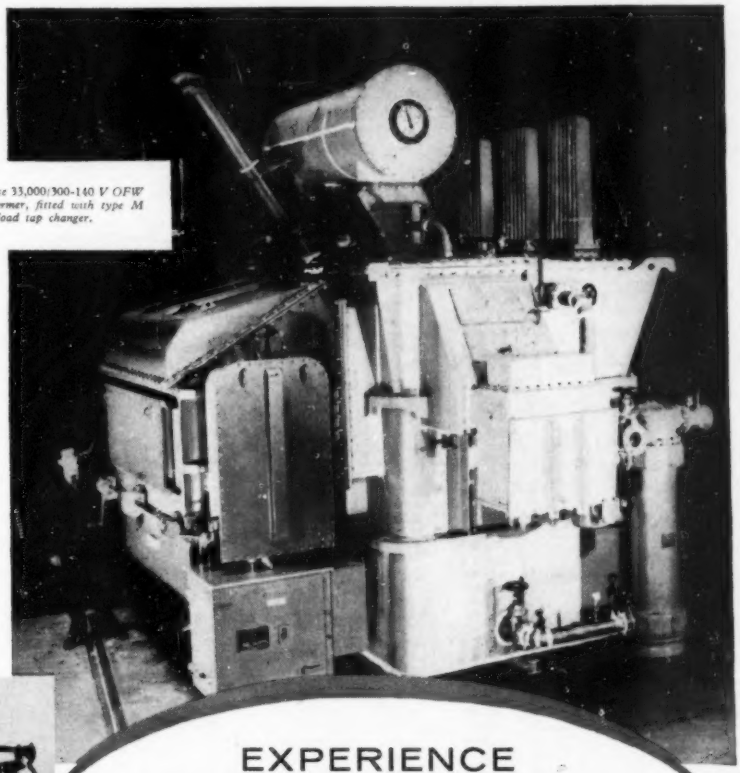
Destination.	Month ended Nov. 30.	Eleven months ended November 30.	
	1961.	1960.	1961.
	£	£	£
Union of South Africa	120,939	460,095	754,199
India	92,092	1,072,378	911,442
Australia	27,860	375,729	315,884
Canada	32,652	281,737	305,629
Trinidad	27,194	314,078	172,684
Other Commonwealth countries and Eire	64,529	1,129,262	1,336,626
Argentina	11	325,708	30,796
Other foreign countries	164,182	2,782,645	2,778,603
TOTALS			
Well-drilling machinery—			
Petroleum	86,368	2,212,772	1,532,012
Other	47,120	445,885	472,096
Mining machinery (excluding portable power tools)—			
Coal-cutters, power operated—			
Complete	60,660	448,522	502,888
Parts	109,501	695,708	816,699
Conveyors, underground—			
Complete and parts	60,566	940,589	765,160
Winders, power operated	74,357	443,499	724,048
All other	90,887	1,554,657	1,882,960
TOTAL	529,459	6,741,632	6,695,863

Rise in Pit Accidents in East Midlands

RECENT figures showed a disturbing rise in the rate of accidents in pits in the East Midlands Division of the NCB, said Mr. W. L. Miron, divisional chairman, at Mansfield. He was speaking at a conference of mining representatives called to launch a divisional drive which will form part of the national campaign "to make 1962 a safety year." The divisional drive would feature mobile exhibitions at Mansfield, Grassmoor, and Coalville; special films in colliery canteens and other places, and safety poster and slogan competitions.

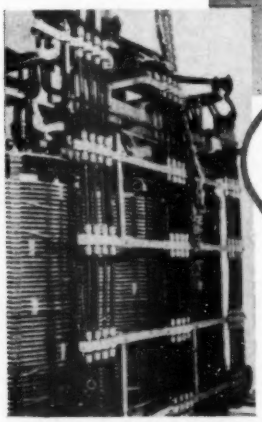
Mr. H. S. Stephenson, Divisional Inspector of Mines, said there had been a 40 per cent. increase in fatalities during the last 12 months, and the accident rate to the end of September had increased by 25 per cent. Health was also important. In the past two years, 500 people had been certified as sufferers from pneumoconiosis.

MEASURES which would curtail strikes by a few men which put thousands out of work have been proposed by the Engineering Employers' Federation, which has asked the engineering unions to accept amendments to the guaranteed working week agreement.



A 10,000 kVA, 3-phase 33,000/300-140 V OFW cooled furnace transformer, fitted with type M resistor transition on-load tap changer.

PHOTO BELOW by courtesy of *N.V. Ned. Kabelfabrieken, Alblasserdam.*



AFTER TEN YEARS' SERVICE

This illustration shows the excellent condition of the windings and connections of a 7,500 kVA, 3-phase, 12,500/234-92 V furnace transformer, removed from its tank for inspection after 10 years' service in Holland.

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Over twenty-five years' practical design and development experience lie behind the arc furnace transformers being supplied to industry today by AEI. These modern units are capable of giving dependable, trouble-free service while withstanding the exacting conditions of arc furnace duty.

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MANCHESTER AND RUGBY

E/A903

Imports and Exports of Iron and Steel

FIGURES of imports and exports of iron and steel in November are given in the following tables, based on the Board of Trade returns, and including totals for the first 11 months of 1960 and 1961.

Total Exports of Iron and Steel

Destination.	Month ended Nov. 30.	Eleven months ended November 30.	
	1961.	1960.	1961.
	Tons.	Tons.	Tons.
Malta	455	5,424	5,163
Sierra Leone	531	7,300	8,590
Ghana	1,203	20,229	17,482
Nigeria	2,294	54,029	59,311
Union of South Africa	5,839	62,696	57,629
South-West Africa	594	5,226	13,420
Rhodesia and Nyasaland	1,932	25,468	27,518
Tanganyika	1,811	14,426	27,775
Kenya	2,146	27,221	34,087
Uganda	211	1,411	2,250
Mauritius	59	4,183	1,594
Bahrein, Qatar, and Trucial States	1,019	13,515	16,433
Kuwait	5,438	5,624	22,719
India	9,644	232,573	170,062
Pakistan	3,287	57,692	71,884
Singapore	1,718	21,330	22,625
Malaya	3,641	16,886	26,225
Ceylon	906	46,071	32,332
British North Borneo	679	4,067	2,921
Hongkong	11,081	75,815	87,330
Australia	4,962	179,039	106,984
New Zealand	8,993	126,563	189,811
Canada	14,808	188,720	117,741
Jamaica	1,182	22,791	14,967
Trinidad	3,112	35,389	41,429
British Guiana	513	8,114	7,659
Other Commonwealth countries	2,218	23,719	27,233
Eire	7,628	57,554	71,219
Soviet Union	4,016	27,122	46,015
Finland	4,342	46,293	57,656
Sweden	12,661	157,705	153,906
Norway	11,469	111,085	119,186
Denmark	7,671	90,260	94,035
Poland	1,732	10,447	44,229
Western Germany	13,919	123,285	111,554
Eastern Germany	3,345	18,549	23,092
Netherlands	8,872	110,017	104,708
Belgium	2,795	29,513	29,074
France	3,232	9,141	14,449
Switzerland	2,474	13,108	21,744
Portugal	2,801	14,773	27,418
Spain	1,532	41,821	23,070
Italy	14,172	41,141	81,766
Austria	556	4,708	5,169
Yugoslavia	1,317	34,682	25,020
Greece	1,333	18,360	31,925
Turkey	390	19,743	12,396
Netherlands Antilles	220	3,119	1,683
Portuguese East Africa	113	4,052	2,164
Egypt	4,996	12,956	31,226
Libya	3,230	34,223	26,831
Sudan	2,621	8,793	11,431
Israel	3,596	17,558	23,166
Saudi Arabia	20	525	1,071
Iraq	1,355	51,472	29,754
Iran	2,550	70,199	32,200
Burma	607	5,213	6,127
Thailand	525	5,905	5,396
Indonesia	1,560	22,010	4,882
China	376	50,613	11,407
Japan	21,221	71,964	177,676
Philippine Republic	170	6,546	5,403
USA	18,308	183,001	135,751
Cuba	9	6,659	858
Mexico	492	5,420	4,314
Colombia	1,471	8,777	16,535
Venezuela	3,568	37,874	27,140
Ecuador	144	2,769	2,350
Peru	541	6,070	8,029
Chile	221	3,810	3,040
Brazil	569	24,730	14,754
Uruguay	706	8,475	8,615
Argentina	13,169	79,165	160,666
Other foreign countries	3,528	55,972	60,895
TOTAL	282,419	3,052,698	3,124,169

Exports of Iron and Steel by Product

Product.	Month ended Nov. 30.	Eleven months ended November 30.	
	1961.	1960.	1961.
	Tons.	Tons.	Tons.
Pig-iron	26,018	136,131	132,462
Ferro-columbium (niobium)	7	96	83
Ferro-tungsten	174	984	1,293
Other ferro-alloys	468	11,117	3,759
Ingots, blooms, billets, slabs, sheet bars (incl. tinplate bars), and similar primary forms	8,955	22,214	99,911
Pieces roughly shaped by forging	340	847	1,877
Iron bars, rods, angles, shapes, and sections	52	1,686	1,795
Steel bars, rods, angles, sections, and shapes	58,210	572,750	617,577
Iron plates and sheets	10	566	805
Universal plates	2,621	20,157	18,181
Steel plate, 3 mm. and under 4.5 mm. thickness	1,861	35,280	35,086
Ditto, 4.5 mm. or more in thickness	29,009	317,094	328,191
Blacksheets and blackplate	27,932	269,806	364,864
Hoop and strip	6,144	95,293	99,367
Tinplate	38,232	457,083	389,485
Decorated tinplate	642	5,716	5,870
Galvanized sheets	3,238	76,347	99,890
Other (incl. tinned sheets, terneplate, and ternesheets)	3,708	26,555	38,626
Railway and tramway construction material	11,639	160,737	170,644
Wire rods of steel (incl. alloy steel)	2,310	50,908	53,582
Wire	9,610	111,101	118,752
Tubes, pipes, and fittings	51239	680,134	580,695
TOTAL	282,419	3,052,698	3,124,169

Total Imports of Iron and Steel

From	Month ended Nov. 30	Eleven months ended November 30.	
	1961.	1960.	1961.
	Tons.	Tons.	Tons.
Union of South Africa	4,635	28,003	34,618
Rhodesia and Nyasaland	880	11,296	20,279
Canada	4,177	247,944	79,251
Other Commonwealth countries and Eire	4,516	49,649	40,851
Soviet Union	6,763	28,076	41,901
Sweden	3,532	46,902	44,302
Norway	3,829	145,845	102,669
Poland	46	8,860	926
Western Germany	7,289	119,336	29,768
Netherlands	22,713	181,916	124,363
Belgium	3,105	108,824	32,050
Luxembourg	485	14,430	10,758
France	1,727	61,242	18,412
Italy	10	21,601	513
Austria	9,610	10,379	13,917
Japan	253	6,636	5,659
USA	901	333,406	11,956
Other foreign countries	150	150,145	11,204
TOTAL	75,421	1,574,490	623,397
Iron and steel scrap and waste fit only for the recovery of metal	1,145	223,971	21,041

Mr. RICHARD TAYLOR, a director of Boulton & Paul, Limited, structural engineers, wire netting manufacturers, etc., of Norwich, for 26 years and joint managing director from 1947 to 1958, has died at the age of 65.

The death has occurred of Mr. WALTER HENRY ROGERS, joint managing director of the Standard Gas Fittings Company, Limited, Birmingham. He joined the firm, founded by his father in 1905, about 40 years ago, and became joint managing director in 1959.

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SITUATIONS VACANT

THE many applicants for the post of MANAGER under Box CC428 are thanked, and advised that the vacancy has now been filled.

JUNIOR MINE SURVEYOR. Required for large Gypsum Mines. Young man age 18/20 years with about three years' experience and educated to about O.N.C. Level. Successful applicant will be required to continue studying on a part-time day basis to H.N.C. and eventual qualification to statutory Certificate. Candidate should apply stating age, educational standard reached, etc., to: MINE SURVEYOR, THE GYPSUM MINES LTD., Mountfield, Robertsbridge, Sussex.

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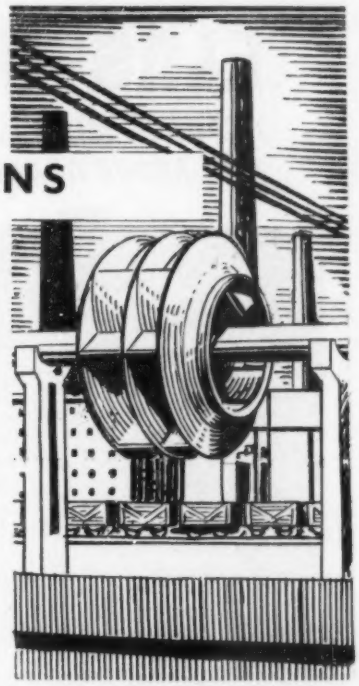

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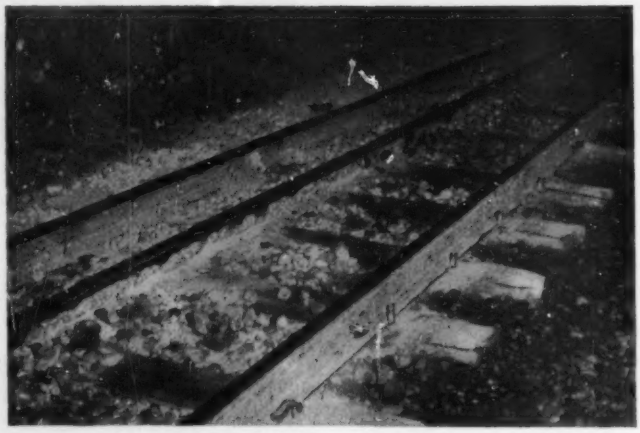

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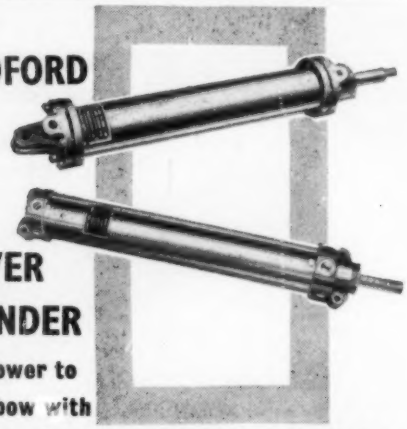

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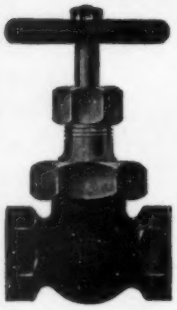

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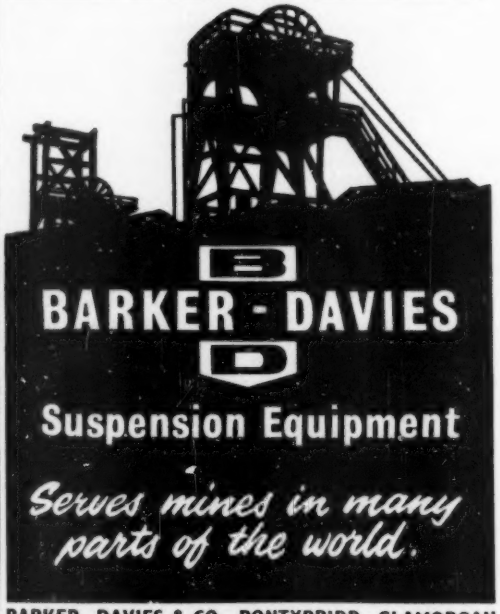

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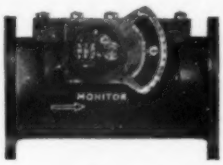

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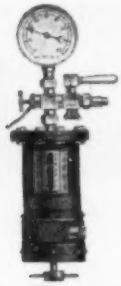
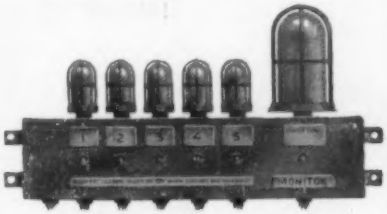


Fig. 2.

Fig 3.



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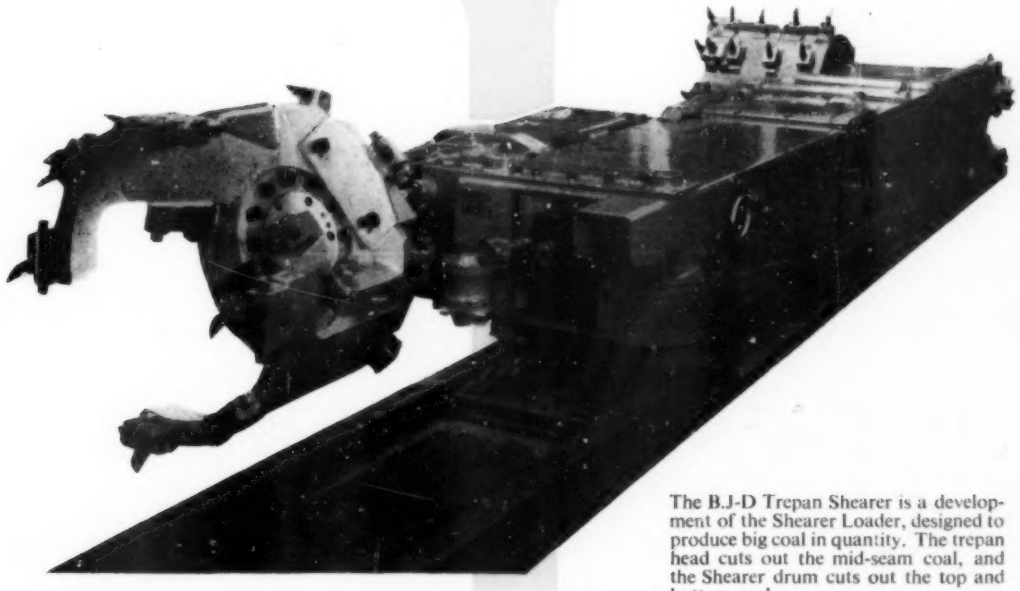

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